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The OIL AND GAS JOURNAL

PUBLISHED WEEKLY DECEMBER 14, 1959

New concept in deepwater drilling —

FLOATING ISLAND

p. 44

Coal's political campaign may hurt oil p. 41

Better results from cat cracking p. 46

Railroad entering LPG pipelining p. 50

More liquids from condensate wells p. 68

Seasons Greetings!

HALLIBURTON OIL WELL CEMENTING COMPANY

DUNCAN, OKLAHOMA

OIL AND GAS JOURNAL
Vol. 57 No. 51

Contents December 14, 1959

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Annual index available on request.

TECHNOLOGY—OPERATION

Production

How to Increase Liquid Recovery from Gas-Condensate Wells 68

By A. W. Francis and Judson D. Lowd

Increasing importance of gas and gas-condensate recoveries demands that high-efficiency recovery methods, screened for economic justification, be used on wet-gas streams. This article establishes the magnitude of the efficiencies obtainable with today's methods and gives practical economic consideration to each of these methods.

Drilling

A New Approach to Mud-Pump Suction Problems 85

By Walter E. Liljestrand

There have been no standards or generally approved formulas for designing or analyzing suction systems for reciprocating mud pumps. A new study analyzes the characteristics of mud-pump suction and suction piping and should be a good basis for preparing standards. It is expected to reduce pumping troubles and costs and permit greater pump output.

Pipelining

Metering Crude Oil with a Turbine 92

By Henning Karlby and Winston F. Z. Lee

This technique has much to recommend it because a turbine will pass dirt without damage, is the least-complicated mechanical meter, has good running balance and low head loss, and can be housed inside the normal pipeline. The compensated metering turbine eliminates change of calibration factor with flow rate and viscosity.

Refining-Processing

American Chemical Corp. Installs Gas-Separation Plant 75

The large package-type low-temperature unit will be installed at American's Long Beach, Calif., chlorinated-hydrocarbon manufacturing center.

How to Select Refinery and Petrochemical Drivers 76

By W. B. Wilson and I. H. Landes

In 1955 and 1956, the latest 2 years for which published data are available, the chemical and petroleum processing industries spent over 2 billion dollars to meet purchased-fuel and electric-power requirements. This cost for energy is 15% greater than the total expenditure for new machinery and equipment during this same period. Thus the importance of proper drive equipment is brought home. Part 2 of two parts.

CO Boiler Pays Off for Utah Oil 80

By Donald G. Ward

Analysis of the results of the first year's operation shows (1) fuel-oil consumption is about 55 to 60% of that needed for conventional boilers; (2) fuel-oil saving will pay out the entire investment in 6.2 years; (3) maintenance costs are low; and (4) no additional personnel were added to operate the boiler.

Lion Oil Completes New Petrochem Facilities 82

Lion is now shipping propylene tetramer material from the El Dorado, Ark., refinery to Monsanto, Ill.

Esso's Welsh Refinery Passes Halfway Mark 90

The 100,000-bbl. per day plant at Milford Haven, Wales, is slated to go on stream near the end of 1960. The refinery will serve Wales and some of the western parts of England and Scotland. Project will cost an estimated $50.4 million.

The Foreman's Page 99

Sample demonstrations show heat and temperature properties of gases, solids, and liquids.

the OIL AND GAS JOURNAL Newsletter

Tulsa, Okla.
Dec. 14, 1959

Pressure is increasing for more states to prorate:

Campaign is urged to spread conservation and proration laws to all oil states in 1960.

Interstate Compact officials have such a proposal under consideration, will decide issue in February.

Back of the request made in Philadelphia convention: Fear that states are approaching a disastrous battle for oil markets that could result in federal proration (p. 53)*.

▼ ▼ ▼

Something to watch: Coal's drive to win markets from oil.

The coal industry means business. Its campaign already is making some headway. Strategy involves use of political pressure, economic pressure, aggressive public relations, and self improvement (p. 41).

Oil is sure to feel the effects.

▼ ▼ ▼

An LPG pipeline is being planned by the Katy Railroad from the Permian basin of West Texas to Minnesota and Wisconsin.

Involved are 2,500 miles of pipe and a $60-million cost.

Katy reportedly has lined up 30,000 bbl. daily of potential business with more interested.

Natural gasoline, propane, and butane would be moved to McPherson, Kans., refining center. From there branch lines would move propane to Minneapolis-St. Paul and Madison, Wis.

Katy project is both a big pipeline development and a boost to LPG industry (p. 50).

▼ ▼ ▼

Some basic changes in the oil industry are being prompted by the world oil surplus, the University of Texas Bureau of Business Research observes.

Companies which are predominately crude producers are in the worst strain. The emphasis now is on marketing. Firms

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*Refers to article in this issue giving more details. Where no page is given, the item is a Newsletter exclusive.

lopsided on refining and low on production are growing scarce. Producers are finding a narrower market for their crude.

Some producing firms are faced with these alternatives: merge with a large marketer or refiner, make huge investment in refining and marketing, or dump crude on the market.

Marketing notes: Denver gasoline price war shows signs of reviving only few days after marathon battle had ended. Conoco cut regular 4 cents to 29.9 a gallon and premium 3 cents to 34.9. Most independents already had regular at 24.9 to 26.9...Saskatchewan officials report price cut in Midale-type crude has stabilized the market for this sour crude and should result in stepped-up production...Atlantic Refining will install new system of data-processing machines next spring to do a multitude of refining and marketing jobs... Signal is starting multigrade marketing of gasoline in California after success of its Nevada tests (p. 43).

▼ ▼ ▼

Total demand for oil products took a hefty jump last week—up nearly 850,000 bbl. daily over the week before.

Unusual strength in the burning oils was responsible. Distillate demand went up 470,000 bbl. daily, kerosine up 190,000 bbl. daily, and residual up 270,000 bbl. daily. Gasoline was off 72,000 bbl. daily—normal for this time of year.

The heavy demand is attributed to cold weather and resumption of steel and other industrial activity.

▼ ▼ ▼

Electronic computer is proving itself economical and useful in oil-processing operations.

Here are some conclusions a recent WPRA symposium reached on use of the computers in refining:

...Biggest processing use is for gasoline blending. This has proved successful for a number of refineries, and one large plant reports savings of up to $2,000 per day.

...Phillips has simulated (made a mathematical model of) its 110,000-bbl. Borger gasoline plant, will soon be optimizing operations there.

...Several companies have simulated complete refineries. Among these are Phillips, Ohio Standard, Cities Service. The average time to simulate a refinery is about 5 man-years.

Refiners need a new approach to cost cutting. They have reached the peak of benefits from bigger plants, pipelines, tankers, etc.

Sun Vice President Clarence Thayer suggests to ASME at Atlantic City the new approach will involve:

...Extending on-stream time. Materials and techniques must be developed so refinery units can remain in continuous operation for 4 or 5 years.

...Shortening down-time. Packaged equipment and components for quick installation, new plant layouts, computer controls by wireless and pipeless system are among the possibilities.

On the labor front:

Esso workers at Baton Rouge are sticking with their independent union in a lopsided vote which snowed under the hopes of Teamster and OCAW unions (p. 54).

Indiana Standard officials are balking at any further concessions in stalemated Sugar Creek, Mo., refinery strike. Long strike also continues at Amoco's Texas City plant where more men are returning to work.

▼ ▼ ▼

Two important Alaskan wildcats have spudded in.

The 1 Nulato, first test in the Kateel-Koyukuk basin of central Alaska, has been started by Mountain States Drilling for a group of leaseholders headed by Paul Benedum. Test is on lower Yukon 350 miles west of Fairbanks and is scheduled for the Devonian at 12,000 ft.

Richfield has spudded its first wildcat on the 489,622-acre Katalla-Yakataga contract. Its 1 Kaliakh is 3 miles north and 18 west of Yakataga federal aviation agency at Icy Bay. It's 50 miles northwest of Phillips' dry holes.

Exploration highlights at home:

First Mississippian production for Colorado is established at Pure's 1 Southeast Lisbon in San Miguel County. It's 15 miles southeast of Pure's Northwest Lisbon, which tested the first Devonian oil for Rockies.

Rockies as a whole probably are enjoying a discovery cycle unmatched in their history. Effects of the successes are being felt in leasing waves throughout region (p. 121).

Ada Oil's 1 Joyce Nance wildcat is a 15-mile jump in testing South Texas' Deep Edwards trend which has featured a series of major extensions this year.

New interest in Black Warrior basin of Mississippi has been aroused by apparent oil discovery at McLean-Hill 1 Brasfield-Boyd Unit in Monroe County. It swabbed 5-15 bbl. of black oil per hour from Chester sand at 2,553-62 ft.

And notes from abroad:

Possible gas discovery looms for Victoria in southern Australia. Frome-Broken Hill wildcat at Port Campbell tested strong gas flow from 5,657-5,718 ft.

India will invite foreign oil companies to join in the search for oil in the country. Mines Minister Malaviya revealed the new trend in explaining the Government's new oil exploration policy to legislators. He said India has about 400,000 sq. miles of potential oil-bearing sedimentary areas spread over many states. Outside help and financing will be

needed to reach production goals of the government.

Iranians are moving cautiously in drilling the Albors structure where a well blew wild for almost 3 months in 1957 (p. 62)...Libya has 3-mile stepout at Oasis' Dahra field. The new Libyan well flowed 2,800 bbl. daily of 43°-gravity crude from two zones. Esso also reports its Zelten 3, which opens a new pay in Libya, is good for 1,600 bbl. daily (p. 64)... Iraq Petroleum faces loss of 60% of its concession covering most of Iraq under a new edict laid down by Kassim (p. 65).

Fresh concept of deepwater drilling is revealed in new floating drilling island developed by ODECO.

The vessel has no hull—it's kept afloat by a latticework of tubular members. Drilling occurs at the center of buoyancy located within the inside angle of the L-shaped island. Cost will be $3 to $4 million (p. 44).

▼ ▼ ▼

Underground waste in Greater Aneth region of Utah has been made an issue now by Superior Oil in wake of spacing controversy (p. 49).

Superior asks that secondary-recovery measures be encouraged or Aneth's solution-gas drive will be ruined and vast amounts of crude be lost.

Its plan: Limit oil production to 230 bbl. daily per well on each 80-acre tract, impose 800:1 gas-oil ratio, increase allowable for water-flood production. Wells now are limited to 350 bbl. daily.

Underground water produced with oil and gas is seen as source of some valuable minerals. Alberta researchers are investigating the commercial possibilities.

Water produced in Wizard Lake field, for example, contains 5.95 lb. of magnesium per barrel, and heavy concentrations of bromine, iodine, calcium, sodium, chloride (p. 60).

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The Washington beat:

President Eisenhower may propose another gasoline tax hike, probably ½c per gal., to provide additional highway funds.

The next federal offshore lease sale will be in late February. Exact date will be announced soon, perhaps this week.

The Federal Power Commission will rule before year's end on the El Paso-Pacific Northwest merger. An FPC examiner has already approved the plan of the two natural gas pipeline firms, and the commission heard final arguments last week.

The Attorney General's annual report on the Interstate Oil Compact Commission is now due back from government printers by Dec. 22.

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V belt briefs

TIPS ON THE CARE, MAINTENANCE AND SELECTION OF V BELTS FOR INDUSTRY

The right way to install and run-in V belts

To get the most possible life out of a set of V belts you've got to install them and run them in properly:

To install V belts:

1. Move driver unit toward driven machine so that belts may be placed in sheave grooves by hand.
2. Work belt slack to top side of drive.
3. Move driver unit back into position, eliminating all belt sag.
4. Check sheave alignment.

To run-in V belts:

1. Start unit and operate long enough to permit belts to properly seat in grooves.
2. Stop unit. Adjust centers as necessary until all belts have proper tension.
3. Review adjustment from 24 hours to 48 hours after drive is in operation. This is important, for new belts stretch slightly and seat in grooves before reaching their working lengths.

It pays to keep belts stored properly

V belts should be stored in a cool, clean, dry place. Avoid heat and direct sunlight. Do not hang on nails or other small objects which might cause a sharp bend or tension that would result in a permanent set in V belt. Oldest belts should be used first to keep fresh stock. Matched belts should be banded together so they don't become separated.

FOURTEEN BELTS BEAT THE WEATHER—*These B.F.Goodrich Grommet belts have stood dirt, dampness, all kinds of weather and the heavy shock loads of a mud pump since they were first installed over 2½ years ago. They've required less takeup than any other belts used by this drilling company, have not caused any shutdowns. When the picture was taken these belts showed little cover wear, looked good for many more years of trouble-free service.*

What caused this V belt failure?

Answer: Prematurely worn sides are caused by grit, dirt or any such abrasive contact. Misalignment often causes wear on one side only. To prevent, align the sheaves, checking with straight-edge or cord. Keep belts and sheave grooves clean.

B.F.Goodrich V belt manual

The illustrated pages of this new B.F.Goodrich V belt maintenance manual contain information that will help you get longer life from your V belt drives. Its 12 illustrated pages contain information on how V belts work, how to select V belts that fit, how to install, how to keep them running, and how to spot trouble. To get your free copy, call any of these B.F. Goodrich warehouses: Los Angeles, Great Bend, New Orleans, Hobbs, Oklahoma City, Tulsa, Dallas, Houston, Odessa, Wichita Falls. *B.F.Goodrich Industrial Products Company, Department M-763, Akron 18, Ohio.*

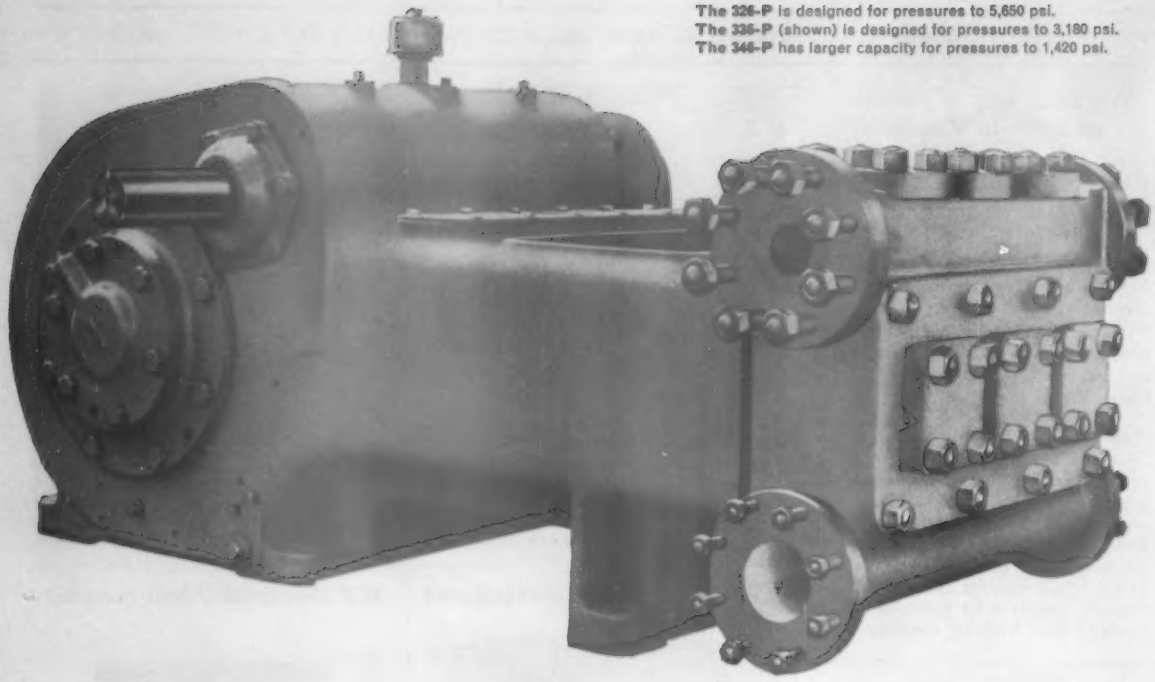
Take a look inside with this X-ray of a Grommet belt

This model of a B.F.Goodrich Grommet belt was made of a transparent, flexible material so that you can see its grommet construction. The two endless loops you see are grommets, the load-carrying members of the B.F.Goodrich belt. These are made by winding heavy cord on itself to make an endless cord grommet.

In the actual belt, these grommets float in a bed of solid rubber. You can *see* why every part of the belt is equally flexible—there are no stiff plies to resist bending. Most cord failures occur where cords overlap. But in the B.F.Goodrich Grommet belt with endless cord construction this cause of failure is eliminated.

B.F.Goodrich V belts

The 326-P is designed for pressures to 5,650 psi.
The 336-P (shown) is designed for pressures to 3,180 psi.
The 346-P has larger capacity for pressures to 1,420 psi.



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All the experience "Oilwell" has gained since introducing the first horizontal plunger pump for waterflooding is reflected in this new pump design.

Fluid Ends are short, strong and compact . . . with heavy walls and streamlined flow chambers, providing minimum stress concentration points. They can be furnished in heavy-duty aluminum-bronze or forged steel.

Individually Replaceable Stuffing Boxes are flanged to the fluid end and are easily serviced through the open-top power-frame cradle. Screw-type packing glands lock to prevent loosening in service.

Double-Ported Valves of corrosion resistant nylon are specially designed for quiet and efficient performance at high speeds.

Lubrication for the Power End utilizes both force-feed and splash systems to assure a dependable flow of oil to all moving parts, including crossheads and plunger shanks.

Added Up . . . these changes result in lower maintenance costs as well as increased permissible fluid-end pressures and operating speeds . . . to give you more barrels-per-day delivery from each pump.

Your "Oilwell" representative has the complete story. See him before you decide upon your next waterflood pumps . . . and you won't want to look any further.

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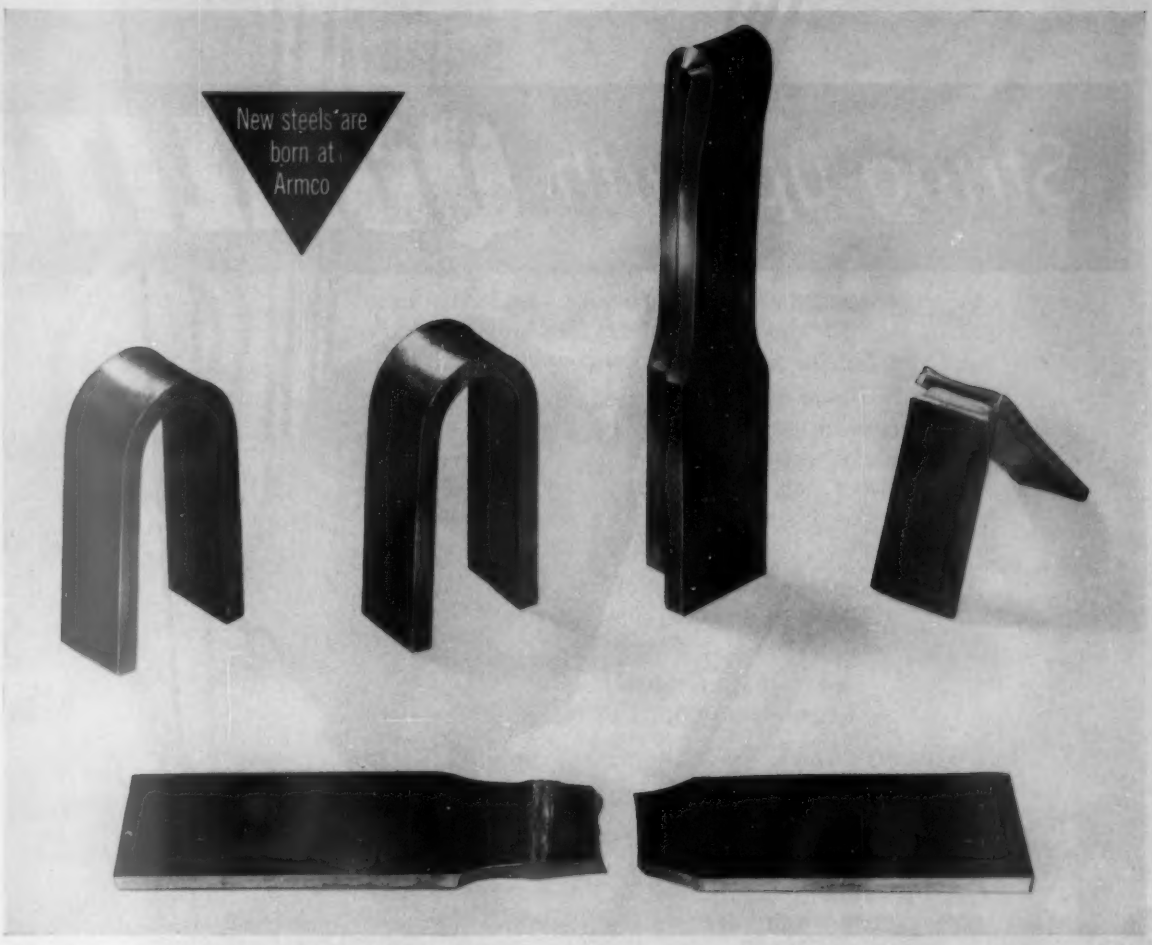

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Model S-3 Casing Centralizer

HALLIBURTON ROTO WALL CLEANER

Newly designed base permits installation either by new no-weld EZ Lok Limit Clamps or by tack welding. This efficient Roto Wall Cleaner minimizes bridge off in annulus, permits more even cement placement around casing for better bonding, reduces lost circulation problems, and minimizes the hazard of "sticking-casing." Economical, too; one size cleaner base fits all O.D. size casing.

Recipo Wall Cleaner installed with EZ Lok Limit Clamp

HALLIBURTON RECIPO WALL CLEANER

This reciprocating type cleaner permits better bonding of cement to formation and casing and aids in extending the well's producing life... by helping to remove undesirable mud or filter cake from bore hole. The Halliburton Recipo Wall Cleaner, hinged for easy installation, offers several advantages: helps remove filter cake at desired predetermined points... reduces circulating pressures and bridging action of filter cake cutting with or without lost circulation materials... minimizes bore hole or filter cake damage, yet cleans wall more thoroughly... cleans larger bore hole area... helps break up channeling action of cement.

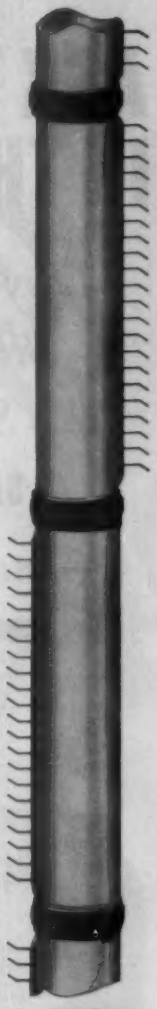
EZ Lok Limit Clamp

HALLIBURTON EZ LOK LIMIT CLAMP

A new, economical, easy-to-use means of installing auxiliary equipment such as reciprocating and rotating cleaners, centralizers, and cement baskets on casing at selected spacing, without welding. Incorporating heat treated steel dogs that grip the casing to help prevent movement of clamp, the new Halliburton EZ Lok Limit Clamp has a unique draw-key latch that compensates for deviation from pipe O.D. With excessive loading from either direction... it holds far more than any other non-weld limit clamp or stop collar tested.

Split Dent Limit Ring

Solid Set-Screw Limit Ring



Roto Wall Cleaners installed with EZ Lok Limit Clamps

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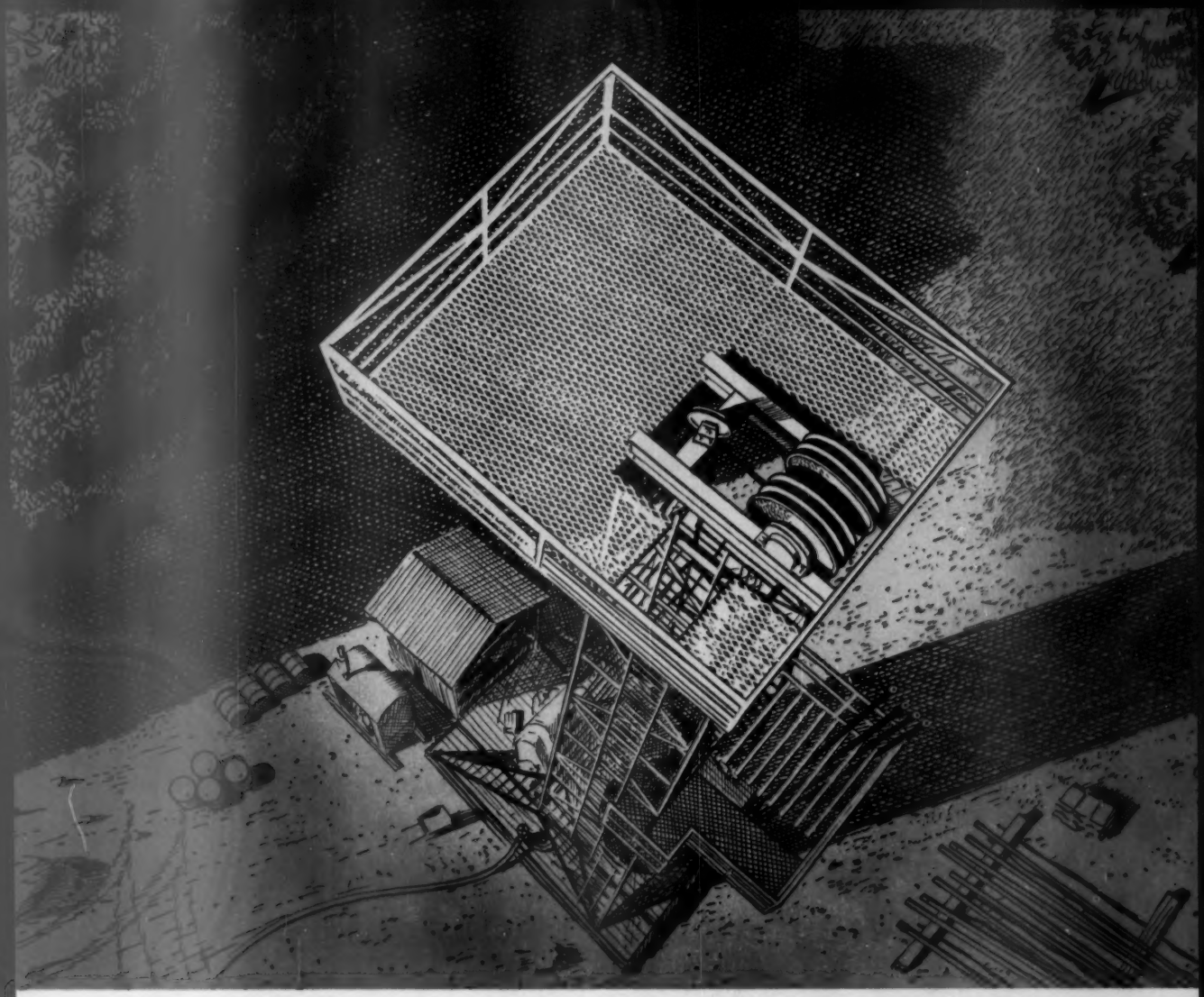

RIGHT...from the top down

A good, dependable water supply system is no better than its beginning. The best beginning is a Layne drilled water well. Layne is the largest water well drilling organization in the world with over 75 years experience. Trained crews operate over 500 drilling and service rigs throughout the country.

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and other allied Drilling Services

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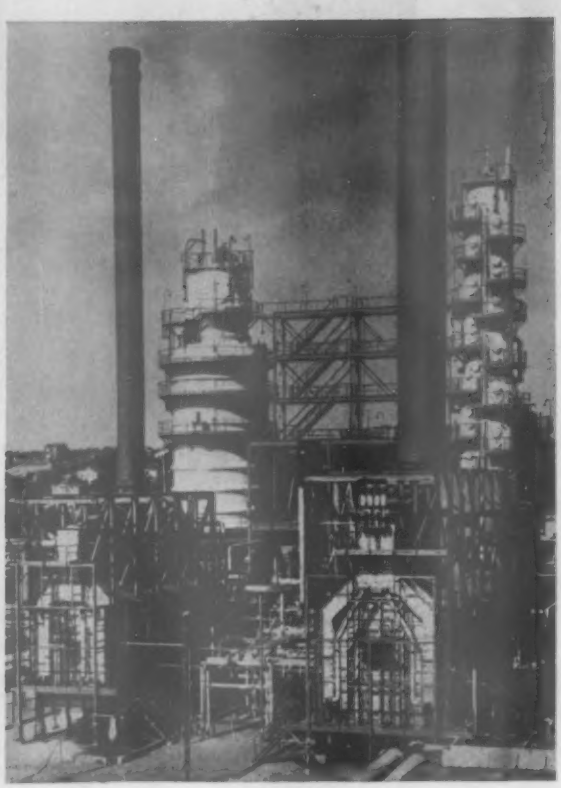

Foster Wheeler Heaters . . .
Different two important ways

Is there really a difference between direct-fired heaters today? The answer is in the story behind the product.

FW built the first modern direct-fired radiant heater some 40 years ago. As refineries and process plants became larger and more complex, FW engineers designed and developed improved heaters for them. The products of this pioneering make up the large selection of modern vertical and horizontal heater designs offered by FW to the process industry today.

And while this wealth of experience is an important difference, there is more than experience alone in the service "package" that goes with FW direct-fired heaters.

This second difference is specialized Heat Engineering . . . FW's way of integrating the heater into the overall process scheme. FW engineers give their heaters the flexibility to meet exacting process requirements. They have demonstrated that whether a single heater is rated at 500,000 or 340,000,000 Btu/hr capacity, there is no need to restrict the ultimate selection with a static product or fixed design. Each FW heater is individually tailored to "your" process.

The result is an efficient, dependable heater . . . a significant contribution to a smooth running and profitable process installation.

To get in touch with FW engineers who can survey your process heating requirements, write to Foster Wheeler Corporation, Department A, 666 Fifth Avenue, New York 19, New York.

Heat Engineered products, plants and processes . . . for the world's industrial progress

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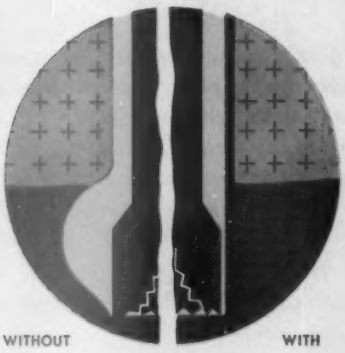
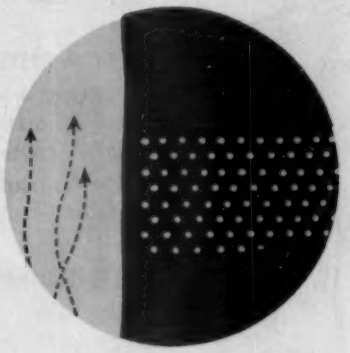
IMPERMEX*

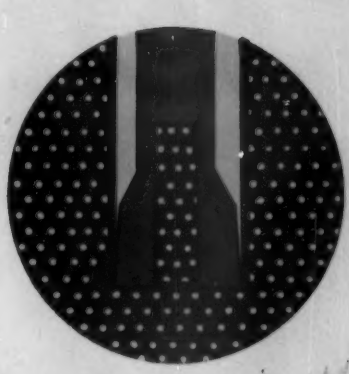
controls *mud filtration properties*



LESS HOLE TROUBLE



PROTECTS PRODUCTIVE ZONES



BETTER CORES AND DST'S

Write for complete technical data bulletin on use of IMPERMEX.

IMPERMEX . . . successfully used for years to control mud filtrate loss.

IMPERMEX . . . controls mud filtrate loss in the presence of all drilled and make-up water contaminants.

IMPERMEX . . . allows better coring and easier drill stem testing.

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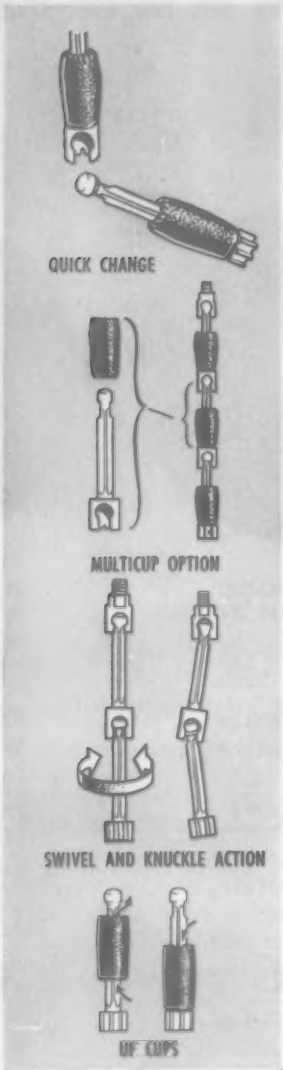
CUT COSTS.. SPEED-UP SWABBING with NEW

GUIBERSON Knuckle Joint Tubing Swab

and SENSATIONAL MULTI-PURPOSE UF CUPS



QUICK CHANGE — New ball-and-socket design, another Guiberson first, lets you change cups in *ten seconds* with the swab hanging on the line.. you don't even have to lay the swab and sinker bars down. No pipe wrenches or other tools are required. This one feature reduces cost tremendously.. but that's not all..

MULTICUP OPTION — Add a cup and upper mandrel.. as many as desired. No need to carry several different swabs.. no time lost in changing swabs. There are only five parts in a two cup swab.. sub, cups, upper and lower mandrels. Heat-treated steel parts are individually tested to withstand heaviest swabbing loads.

SWIVEL AND KNUCKLE ACTION—You get full 360° swivel at the bottom socket joint and 5° knuckle action at every joint. With any number of cups and even in crooked tubing, the combination of knuckle action and ample bypass makes this the fastest-falling swab ever run.

UF CUPS — Are strong, flexible, long life.. made from special compound with a valve ring molded in the base. Thus, new valves are obtained each time the swab is redressed. Cups travel freely on the mandrel, allowing bypass inside and outside the cup in the up position.. sealing perfectly in down position. The UF cups, designed especially for the knuckle joint swab, are strongly reinforced for heavy loads.. flexible enough for light loads.. small enough for tight tubing. Use the knuckle joint swab with UF cups and lift more fluid in fewer trips.

SAVE MONEY ON YOUR NEXT JOB WITH THIS SWAB

Sold by OIL FIELD SUPPLY STORES EVERYWHERE

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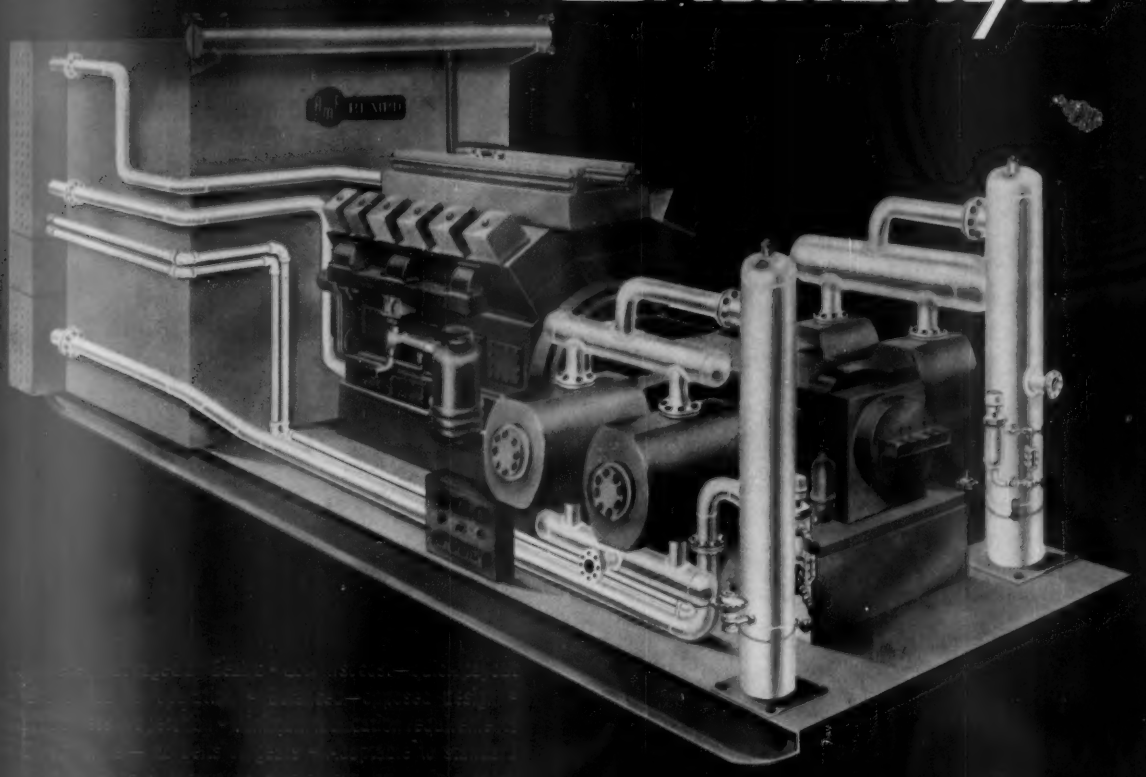

PACKAGED COMPRESSORS 100 TO 400 HORSEPOWER

NEW FROM BEAIRD... Economical HHE Series Packaged Compressor Plants. Gas engineered and completely packaged by Beaird, the HHE Series compressors offer new economy and flexibility of operation in a horsepower range below Beaird Ingersoll-Rand SVG compressors.

Beaird HHE Units are furnished in two and four cylinder models covering a range of 100 to 400 horsepower. They can be designed with one, two or three stages of compression.

HHE Compressors are of the balanced opposed design that provides smoothest operation and best running balance. Ideally suited to barge or piling installations, they are vibration free and can be mounted on minimum foundations. The driving engine is directly connected to the compressor by a simple block coupling. No belts or gear trains are required. Any oilfield engine of adequate horsepower can be specified by the purchaser.

Completely packaged compressor stations, Beaird HHE Units are furnished with every control, valve, scrubber, manifold and connection needed to place them into operation. The radiator includes cooling sections for engine water and oil, as well as gas interstage and after cooling, when desired. Mounted on the main skid as an integral part of the compressor package, radiators may be furnished with either horizontal or up-draft air discharge. Fully assembled on rigid skids, an HHE Packaged Compressor Plant moves as a single load on standard oilfield vehicles.

another AMF BEAIRD product

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$q = hA\Delta T$.....puts the *"anti"* in anti-freeze!

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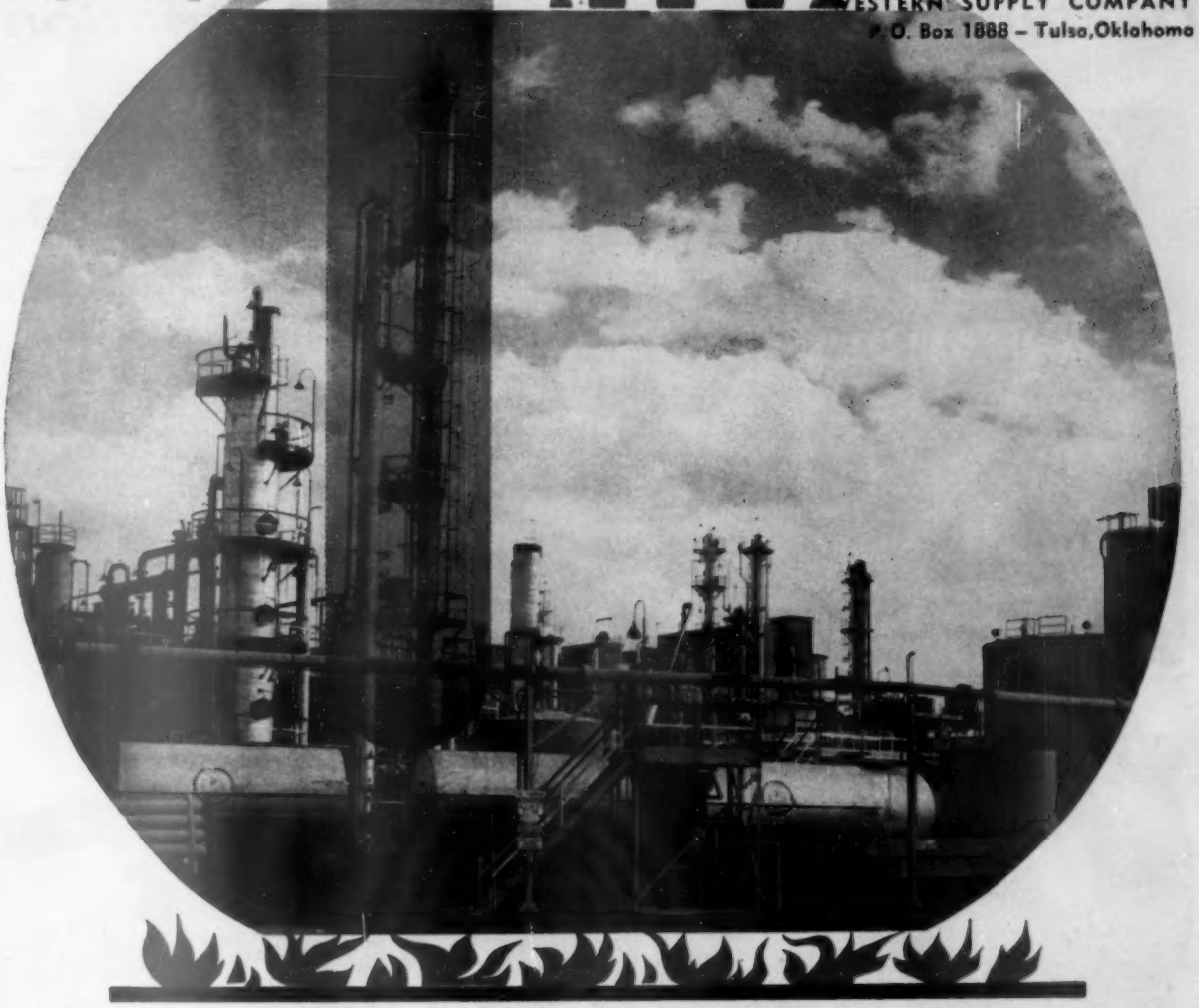

Anti-freeze is but one of many products whose origin can be traced to the South Works of Wyandotte Chemicals Corporation, Wyandotte, Michigan. In the Propylene Oxide Plant of the South Works, shown above, Western Heat Exchangers render a significant and vital service to Wyandotte's continuing growth in organic oxide chemicals.

Precise engineering, practical design and close attention to detail characterize all Western heat exchangers — tailored to the process requirements of the nation's leaders in petrochemicals.

A Western representative stands ready to help with your heat transfer requirements.

HEAVY DUTY BALL BEARINGS . . . The ball bearings used in these motors are of the highest quality, with more than ample capacity to provide long trouble-free service under heavy loads.

BEARINGS CAN BE RELUBRICATED . . . Original factory lubrication will last for years in normal service—but convenient grease plugs are provided to permit relubrication that adds to motor life under severe conditions.

SECURELY SEALED FOR LOW MAINTENANCE . . . Both ends of these motors have running shaft seals to keep the bearings clean. Bearing housings are effectively sealed to prevent escape of grease.

Wagner Totally Enclosed Motors

Designed to give you Extra Protection

PROTECTED AGAINST CORROSIVE... ABRASIVE AND EXPLOSIVE ELEMENTS

WM59-7

Here are motors that will deliver full-rated horsepower under the toughest service conditions—that will help you keep your production rates up, and give you the kind of dependable, continuous operation that is so important to automation.

Type EP Motors are fully protected against damage from corrosion, dust, abrasives, fumes, steel chips or filings. Type JP is explosion proof as well—is designed and approved for use in explosive atmospheres.

Integral ratings, 1 through 100 horsepower, are built in the latest NEMA frames, 182 through 445 US, with ribs that add mechanical strength and increase the surface cooling area.

Let your Wagner Sales Engineer show you how these protected motors can bring you savings on initial motor costs, maintenance costs, and in continuity of operation.

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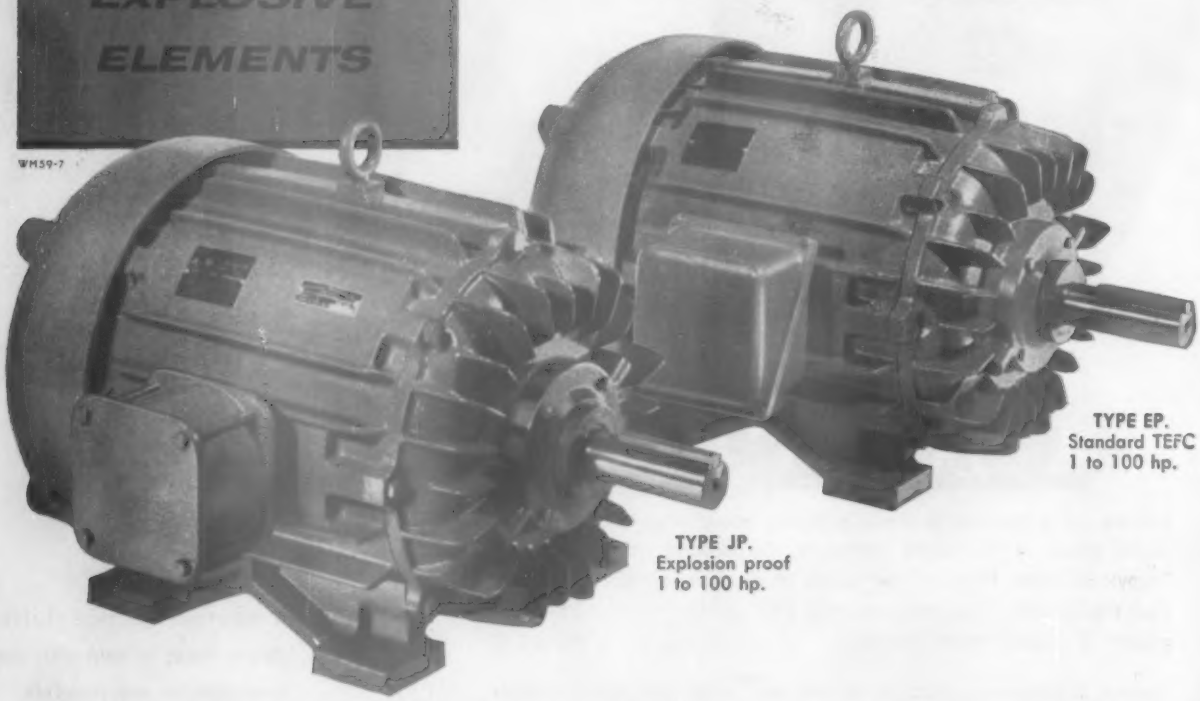

TYPE EP.
Standard TEFC
1 to 100 hp.

TYPE JP.
Explosion proof
1 to 100 hp.

OTHER FRAME SIZES AVAILABLE IN RATINGS THROUGH 500 HP.

DOW | HERBICIDES

Where there are weeds, there's a business hazard
. . . eliminate them with low-cost, long-lasting **GARLON**

Weeds and grasses create potential fire hazards . . . speed up decay and rusting . . . prevent easy inspection of pipelines, valves, and security fences . . . and provide a perfect hiding place for rodents (and lost tools and equipment). You can cut them regularly, but that's the expensive way to use maintenance man-hours.

Professional contractors prefer and use Garlon*, the double-duty herbicide that kills both broad-leaf weeds *and* nuisance grasses with the same mixture. Cost records show substantial savings by switching from hand cutting, or using high-priced "soil sterilants" . . . compared to spraying the low-cost way —with Garlon. Garlon kills unwanted vegetation from the top leaves to the deepest roots without depending on rainfall to wash the chemical to the roots. One application and a spot treatment usually last a full season . . . or longer.

Mail the coupon below for more information and/or the name of a qualified professional contractor near you. Or call your nearest Dow Sales Office. There's one in nearly every major city.

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Agricultural Chemicals Sales Dept. 208DC12-14
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☐ Please send me additional information about Garlon and modern vegetation control chemicals.

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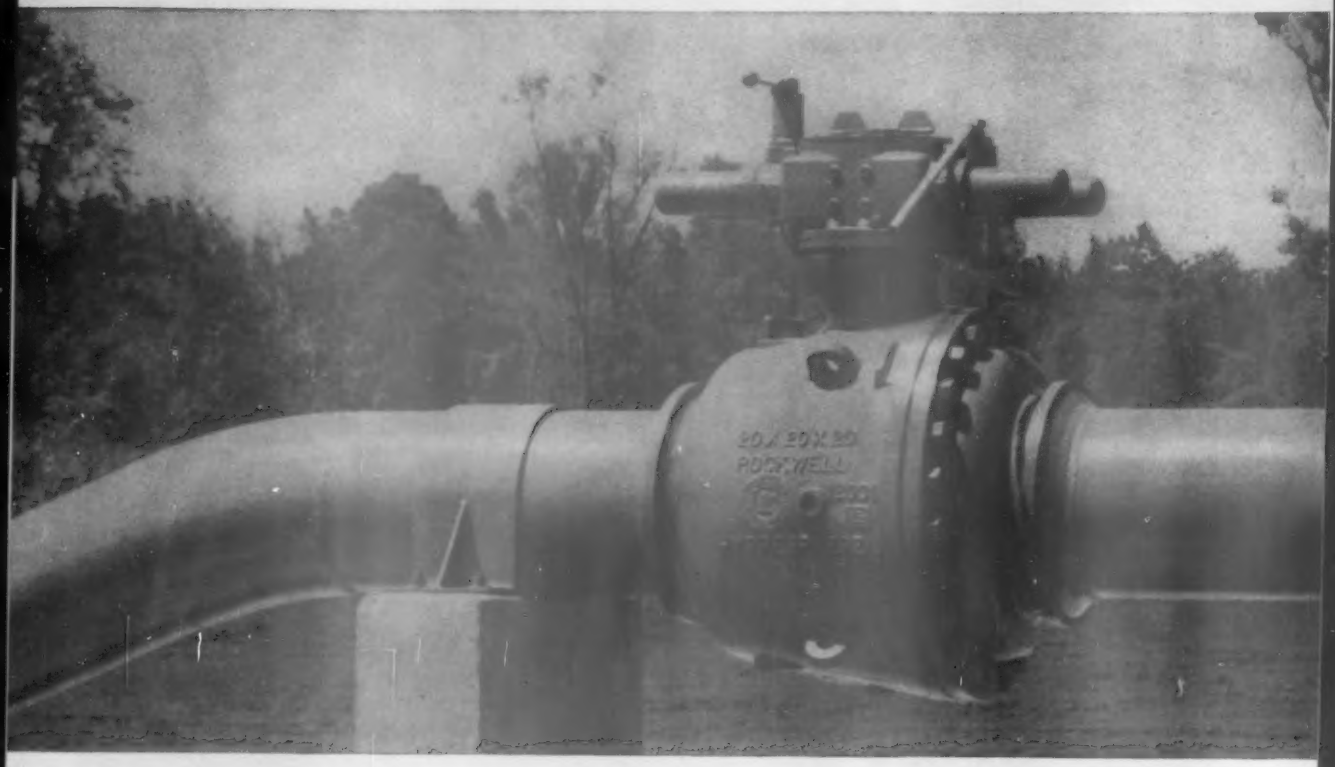


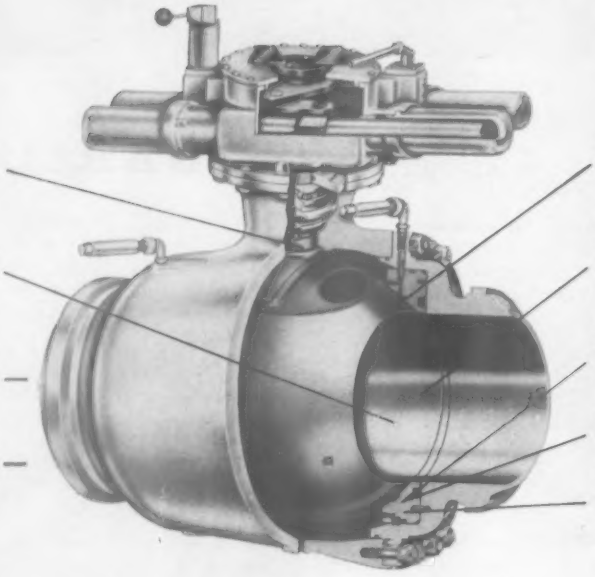
THE ROCKWELL

POSITIVE ROTARY ACTION: Low torque, lubricant-smooth closure in just a quarter turn . . . no wedging of seats.

FULL OPENING, ROUND BORE: Straight-through flow—no obstructions to hinder scraping.

COMPACT DESIGN: The Hypresphere is lighter and more compact than any valve of equivalent rating.

MAXIMUM STRENGTH: Line pressures perfectly distributed against firmly seated, spherical plug for maximum strength, minimum deflection.



LEAKPROOF: Sealdport lubricant sealing between plug and seat rings assures tightest shut-off possible.

EITHER-WAY FLOW: No single pressure side because valve closure isn't dependent on springs or wedging.

PERFECT SEATING: Spherical plug seats snugly into seat rings . . . the greater the line pressure the tighter the shut-off.

PROTECTED SEATING: Seats are fully protected and self-cleaning.

SELF-ADJUSTING PLUG: Both plug and seat rings are full floating for perfect self-adjustment.

There are only four main parts in a Rockwell Hypresphere valve . . . it's the simplest yet most efficient design imaginable. The spherical plug (a) is firmly seated against the seat rings (b) in the valve body (c). The stem (d) is independent of the plug. There are only two main moving parts: the stem and spherical plug in the valve proper.

cut pipeline valve costs

HYPRESPHERE VALVE

The Rockwell Hypresphere pipeline valve is one of the most thoroughly proven "new" products available. A decade of development plus 6 years of field performance have been documented to give you the assurance of a valve that shuts off tighter, operates more dependably, and costs less to use year after year.

The Hypresphere is a spherical plug valve to which the long proven Sealdport* pressurized lubrication system has been applied. The result is a full opening, round bore pipeline valve with all the advantages of lubrication . . . positive shut-off, easy operation, and longer life at far lower cost. Especially designed for pipeline flow control where a full-opening, round bore valve is desired to facilitate scraping, the Hypresphere allows free, easy passage of all types of pigs.

Reg. T. M. Rockwell Manufacturing Company

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ROCKWELL HYPRESPHERE VALVES

another fine product by

ROCKWELL

Take a look at the cutaway drawing at the left for just a few of the basic advantages that will help you get better flow control at far lower cost with Rockwell Hypresphere Valves.

For every pipeline flow control job, here's the valve line that will do the job better, longer and at far lower cost . . . better because they are lubricated.

Rockwell-Nordstrom Hypreseal Valve

Rockwell-Nordstrom Multiport Valve

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Pittsburgh 8, Pa.

☐ Please send literature on the new Rockwell Hypresphere valve.
☐ Please have your field engineer call with complete details.

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10/15/59

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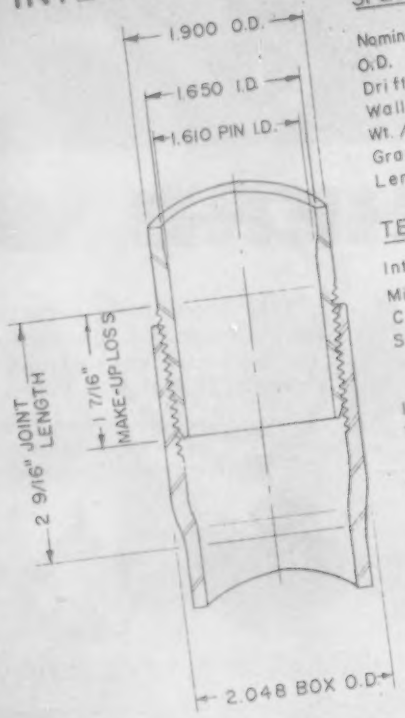
Field Superintendent—
This could mean big savings
on our dual completions
and slim hole program.
Suggest you look into it.
J.C.C.

1 1/2" x .125 WALL TEX-TUBE INTEGRAL JOINT OIL WELL TUBING



SPECIFICATIONS

Nominal size	1 1/2"
O.D.	1.900"
Drift I.D.	1.556"
Wall	.125"
Wt./ft.	2.40 lbs.
Grade	J-55
Length	Rg. 2

TECHNICAL INFORMATION

Internal Press.- min. Yield	6,330 PSI
Mill Test	3,000 PSI
Collapse Press.	5,787 PSI
Setting Depths: (feet)	
Collapse s.f. 1.125	10,280
Tension s.f. 1.8	7,100

1 1/2"- 10 Rd. Reg. Thrd. Interchangedble with 1 1/2" A.P.I. Non-Upset Tubing

CONSUMER PRICES f.o.b. Houston, Texas

Carload	$ 50.13
Less than carload	$ 55.44

POWER TIGHT MAKE-UP AT 1 V2 THREADS – TOLERANCE 350-450 FT. LBS. ± 1 1/2 THREADS

1 1/2" SERIES 301 x .125 Wall integral Jt.

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SHEET 1 OF 1 SHEETS		

Roiline L-3460
7¼-in. bore x 7-in. stroke; 12-cyl. V-type; speed range 600 to 1350 rpm; 640 max. hp.

Three ROILINE Model L-3460 Drilling Engines on a Brewster N-12 drawworks and an L. C. Moore 142-ft. mast—going strong at 9,849 ft. and bound for the 12,500 ft. Ellenberger Zone in the Permian Basin. With 4½-in. pipe, drilling superintendent Alford has pulled a 90-ft. treble stand in 40 seconds. He has averaged a treble stand a minute. These big ROILINES have the quick response, fast acceleration, and the reserve power to cut round trip time to a minimum.

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FOR COST-CUTTING PRODUCTS
THE KNOW-HOW TO USE THEM

There are three sound reasons why Magcobar can cut your drilling costs. First, proved excellence of products. Second, the industry's best trained mud engineers plan the mud program for your well and keep it running smoothly. Third, extensive research facilities keep bringing you the best drilling chemicals and additives for your particular problems.

Bringing these three important reasons for Magcobar superiority to their present high level can never be the work of a day or a year by any company. Product quality is based only on careful controls and strict analyses from production to well. A mud engineer's skill is born with training in the lab—a big lab with experience—matures under a wide range of field conditions, and reaches full power in the continual mastery of new techniques, new products. And research, a word frequently sinned against, means continuing expense, continuing outlay of cash to keep on providing the drilling industry with the best products and techniques.

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They Say—

Who was wrong and when

Dear Sir:

During temporary shortages influenced by the Korean War, nearly all the major oil companies inaugurated greatly expanded, and as now suggested, completely unjustified domestic exploration programs.

Now within the short space of less than 8 years, we find the situation exactly reversed. A very mild depression and an excess of supply have resulted in extreme curtailment of domestic exploration. The increase of world-wide reserves has not been sufficient to justify such a complete reversal of policy. Managements in general either made a very bad estimate of the situation in the early fifties, or else are making a bad estimate now.

All during this period the 27½% depletion allowance has remained unaltered. If it had been reduced, I presume managements would be blaming the "necessity" for reductions in exploration on that factor!

Oil companies are now setting up "super vice presidents" in charge of propaganda, Washington lobbies, and "political action committees" all to resist changes in 27½%.

Yet the only justification for the principle of depletion allowances (from the public good angle) is to encourage the expenditures for the discovery of more domestic reserves. I propose that, as the general public and our lawmakers are not completely dumb, a more favorable reaction to the retention of 27½% will be obtained from pursuing an intelligent and consistent policy in regard to domestic exploration effort.

An Oil Worker
Iran.

(Name withheld by request).

Unfaithful reader

Dear Sir:

I am surprised that your magazine has not had a special article on the oil possibilities of the Arctic Islands.

This is one of the biggest oil plays in the world and leading geologists that are familiar with the Arctic tell us that the formations and structures equal, or are bigger than, the Middle East and that the sediments are possibly 40,000 ft. thick.

If these structures are oil bearing, we are looking at a play that may

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change the North American or world oil market since it is half the distance from the Arctic to Europe and Japan as it is from the Middle East.

I believe your magazine has overlooked the Arctic Islands and I hope you will correct the oversight in your next issue.

(Name Illegible)
"A Faithful Reader"

(Editor's note: We're surprised too! "Faithful Reader" surely couldn't have missed these stories on the Arctic Island play: April 21, 1958, p. 98: Sept. 15, 1958, p. 118; Jan. 19, 1959, p. 166; Feb. 23, 1959, p. 76; Mar. 16, 1959, p. 160; Aug. 17, 1959, p. 150 (6⅓ pages!); Oct. 5, 1959, p. 2; Nov. 9, 1959, p. 111).

Tanker of the future

"One of the areas where the economics of atom propulsion seems most promising is in the tanker field.

"The Maritime Administration has been considering for over 3 years various avenues of approach to building a nuclear tanker for the American Merchant Marine.

"Both industry proposals and government-sponsored projects have been explored, in collaboration with the Atomic Energy Commission, and reported from time to time to the House committee on merchant marine and fisheries and to the joint committee on atomic energy.

"The industry proposals for joint participation by private oil companies, tanker operators, and shipyards with the Government, under some form of governmental aid, have been largely informal and exploratory in nature.

"Esso Shipping Corp. has employed General Electric Co. to make design studies of a nuclear tanker, but has not yet released their findings.

"Cities Service Oil Co. has made proposals and while we know less of their progress, there is reason to believe that Cities Service is still seriously interested in a nuclear-tanker program and will proceed whenever a satisfactory and feasible formula for government participation has been worked out."

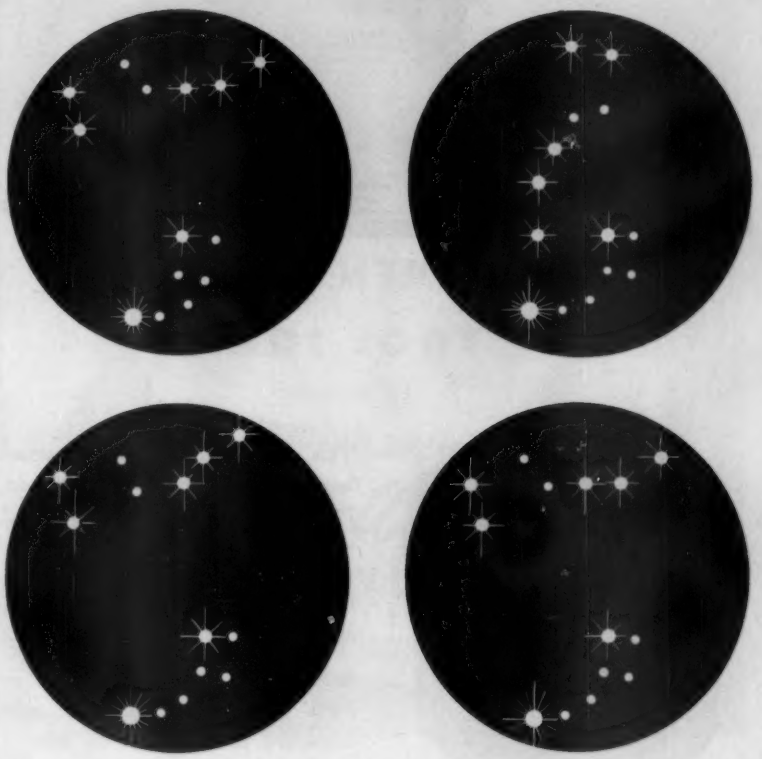
Thomas E. Stakem, member Federal Maritime Board, in a speech to the Foreign Trade Association of Southern California, Los Angeles.

Time for action

"At this time of the year the men who plan oil company operations are drawing up budgets for 1960 operations.

"The importance of this to Canada, and particularly to Alberta, is the im-

Which star pattern is correct?



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You can be sure of getting the genuine article every time when you buy chemicals made by Wyandotte! Product line of uniform quality, including materials for drilling muds, gas dehumidification, demulsifying, emulsifying, secondary recovery, water treatment, cementing, sweetening and many other petroleum, refinery, and petrochemical applications. Get full details from your distributor, or write: *Wyandotte Chemicals Corporation, Wyandotte, Michigan. Also, Baton Rouge, Louisiana. Offices in principal cities.*

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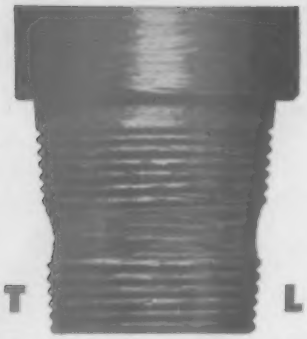
SODIUM CMC • ETHYLENE OXIDE • ETHYLENE DICHLORIDE • POLYETHYLENE GLYCOL • PROPYLENE OXIDE
PROPYLENE DICHLORIDE • POLYPROPYLENE GLYCOL • DICHLORODIMETHYLHYDANTOIN • CHLORINATED SOLVENTS
OTHER ORGANIC AND INORGANIC CHEMICALS



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portance of millions of dollars in the economy.

"The planners must be able to estimate the markets for oil and natural gas in the coming year. This they are not able to do because the government of Canada awaits action by a National Energy Board now being formed.

"The delay can cost Canada the millions of dollars which might be spent here if the policy were clear. And it is an unnecessary delay.

"Before the government at the moment are applications for natural-gas export to the U. S. which have been considered by other bodies, such as the Borden Commission, and approved and accepted by the U. S. The Alberta conservation board has studied the technical questions involved and the chairman of that board now heads the energy board.

"Surely it is not too much to suggest that work that has already been done need not be done again and the energy board is now qualified to approve some export, subject to settling minor details."

Editorial in the Calgary Herald.

Letters to They Say should be addressed to The Editor, The Oil and Gas Journal, Box 1260, Tulsa, Okla.

CALENDAR

JANUARY

11-13 Alberta Society of Petroleum Geologists, first international symposium on Arctic geology, Hotel Palliser and Jubilee Auditorium, Calgary.

11-15 Society of Automotive Engineers, annual meeting, Sheraton-Cadillac Hotel, Detroit.

15-16 Association of Oilwell Servicing Contractors, annual meeting, Baker Hotel, Dallas.

17-19 Kansas Oil Men's Association, annual convention, Broadview Hotel, Wichita.

18-20 Kentucky Petroleum Marketers Association, annual meeting and convention, Brown Hotel, Louisville.

22 Natural Gasoline Association of America, Gulf Coast regional meeting, Robert Driscoll Hotel, Corpus Christi, Tex.

25-28 Plant Maintenance and Engineering Show, produced by Clapp & Poliak, Inc., Convention Hall, Philadelphia.

31-Feb. 3 Pipe Line Contractors Association, annual meeting, Ambassador Hotel, Los Angeles.

FEBRUARY

1-4 Instrument Society of America, instrument-automation conference and exhibit, Rice Hotel and Houston Coliseum, Houston.

8 Alberta Division of Canadian Petroleum Association, annual meeting, Hotel Palliser, Calgary.

7-10 American Association of Petroleum Geologists, Rocky Mountain section annual meeting, Billings, Mont.

14-18 American Institute of Mining, Met-

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ONE THIRD LIGHTER

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AMERICAN IRON OPEN-HOLE TOOL JOINTS

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Here's how they **keep mud moving** *on "Mister Cap"*

Mounted directly above the mud tank—with its steel shaft reaching down into the mud—is a LIGHTNIN Mixer.

At the bottom of the turning shaft, a big turbine-type impeller drives the mud in a steady, powerful flow. All through the tank, mud keeps mixing, interchanging, equalizing. It doesn't settle out. It's always in condition. And if necessary, mud weight and viscosity can be changed at the drop of a hat.

This is what you'll see aboard "Mister Cap," the 4000-ton all-electric offshore mobile drilling barge that brought in its first producer in just eight days—and has been meeting its owners' expectations ever since as a model of drilling efficiency.

You can get faster, safer, more productive drilling with LIGHTNIN Mixers on *your* rigs. Fewer stops. No long waiting for mud to get into condition. Surer protection against blowouts.

Cut pump maintenance cost, too. When you have LIGHTNIN Mixers you don't have to use your standby pump for jetting mud. It's always instantly available for use on the hole.

See for yourself why so many offshore and land rigs use this simple, fast way to control mud. Ask your LIGHTNIN Mixer representative to set up a visit to one of these rigs in your area. Call him today (he's listed in Composite Catalog). Or write us direct.

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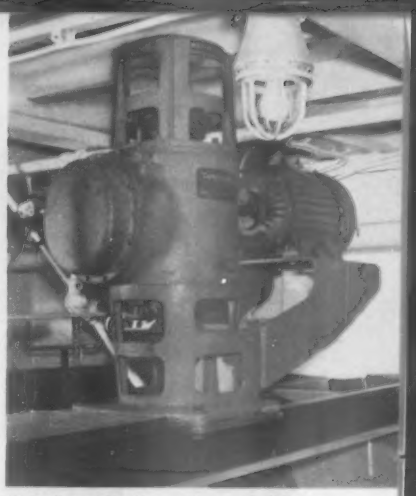
In Canada: Greey Mixing Equipment, Ltd., 100 Miranda Ave., Toronto 19, Ont.



Mud mixers like this one keep all of the mud in suspension, with uniform gravity and viscosity.

THREE-LEGGED JOB-HOPPER "Mister Cap" spudded and drilled its first producing well in 8 days; has worked steadily in the Gulf since November 1957. Built by R. G. LeTourneau Inc., the barge is owned and operated by Barnwell Offshore, Inc.

allurgical, and Petroleum Engineers, annual meeting, Statler-Hilton and McAlpin hotels, New York.

21-24 American Institute of Chemical Engineers, meeting, Biltmore Hotel, Atlanta.

24-25 Wisconsin Petroleum Association, annual convention and exhibit, Schroeder Hotel, Milwaukee.

24-26 National Association of Corrosion Engineers, Tulsa section, eleventh annual corrosion short course, Mayo Hotel, Tulsa.

26 Natural Gasoline Association of America, Permian Basin regional meeting, Lincoln Hotel, Odessa, Tex.

26 Ohio Oil and Gas Association, winter meeting, Deshler-Hilton Hotel, Columbus, Ohio.

MARCH

2-4 American Petroleum Institute, Division of Production, southwestern district meeting, Statler-Hilton Hotel, Dallas.

7 Canadian Petroleum Association, annual general meeting, Hotel Palliser, Calgary.

14-18 National Association of Corrosion Engineers, sixteenth annual meeting, Memorial Auditorium, Dallas.

16 Petroleum Equipment Suppliers Association, eastern district membership meeting, Duquesne Club, Pittsburgh.

16-18 American Petroleum Institute, Division of Production, southern district meeting, Hilton Hotel, San Antonio.

18 Natural Gasoline Association of America, Oklahoma regional meeting, Biltmore Hotel, Oklahoma City.

21-23 Midwest Gas Association, annual meeting, Hotel St. Paul, St. Paul.

22 Petroleum Equipment Suppliers Association, Gulf Coast district membership meeting, Shamrock Hilton Hotel, Houston.

24-25 New England Gas Association, annual meeting, Hotel Statler-Hilton, Boston.

28-30 Western Petroleum Refiners Association forty-eighth annual meeting, Hilton Hotel, San Antonio, Tex.

29-31 American Power Conference, annual meeting, Sherman Hotel, Chicago.

30-Apr. 1 American Petroleum Institute, Division of Production, Mid-Continent district meeting, Broadview Hotel, Wichita.

APRIL

3-8 Engineers Joint Council, sixth nuclear congress, New York.

4-7 Oil Heat Institute of America, annual convention, Park-Sheraton Hotel, New York.

4-7 National oil heat and air-conditioning exposition, Coliseum, New York.

5 Petroleum Equipment Suppliers Association, southern mid-continent district membership meeting, Statler Hilton Hotel, Dallas.

5-7 Instrument Society of America, national chemical and petroleum instrumentation symposium, Rochester, N. Y.

12-14 Petroleum Industry Electrical Association, Petroleum Electric Supply Association, conference and exhibition, Municipal Auditorium, Kansas City.

19-21 University of Oklahoma, College of Engineering, southwestern gas measurement short course, north campus, University of Oklahoma, Norman.

20-22 American Petroleum Institute, Division of Production, Rocky Mountain district meeting, Gladstone, Henning, and Townsend hotels, Casper, Wyo.

20-22 National Petroleum Association, semiannual meeting, Hotel Cleveland, Cleveland.

21-22 Texas Technological College, seventh annual West Texas oil lifting short course, Lubbock, Tex.

21-23 Society of Economic Paleontologists and Mineralogists, Permian basin section annual meeting and field trip, Abilene, Tex.

24-26 Independent Petroleum Association of America, midyear meeting, Denver Hilton Hotel, Denver.

25-27 Southern Gas Association, convention, Buccaneer and Galvez hotels, Galveston.

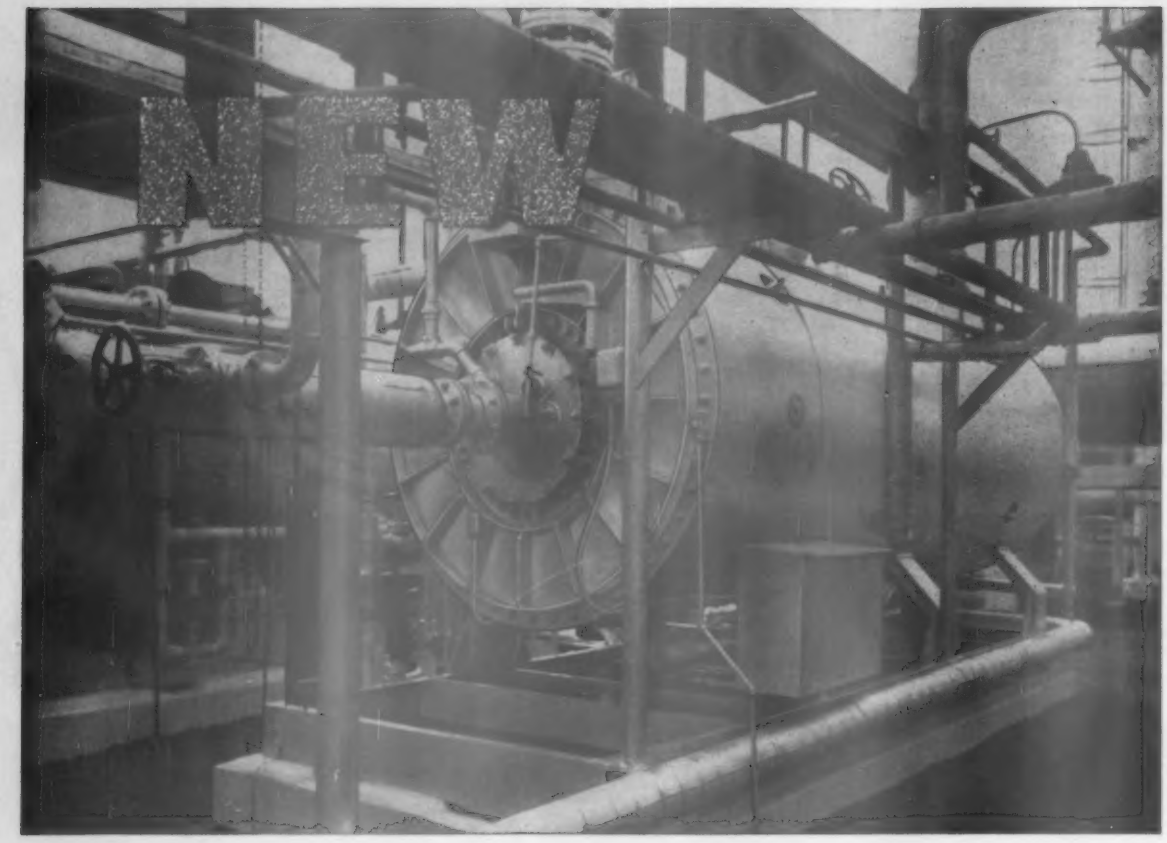
25-28 American Association of Petroleum Geologists, Society of Economic Paleontologists and Mineralogists, annual meeting, Chalfonte-Haddon Hall, Atlantic City, N. J.

25-29 American Welding Society, annual meeting and welding exposition, Los Angeles.

26 Petroleum Equipment Suppliers Association, Pacific district annual membership meeting, Ambassador Hotel, Los Angeles.

27-29 Natural Gasoline Association of America, annual convention, Rice Hotel, Houston.

28-29 American Petroleum Institute, Division of Transportation, pipeline conference, Mayo Hotel, Tulsa.



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- **Compact—Sulfur Furnace and Steam Recovery in Single Packaged Unit**
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- **Long, Maintenance-Free Life**
- **Higher Sulfur Recovery Yields**
- **Simplified Control**

The new AMES packaged sulfur recovery furnace is specifically designed for sour gas sulfur recovery operations. It is well adapted to refinery tail gas or sour gas production field "off gas" recovery. Its outstanding efficiency and economy have been proven in use. Through a unique control arrangement, a constant temperature feed stream to the catalytic converter is assured, resulting in high yields throughout wide variations in feed gas rates and composition.

The AMES unit shown here has been giving virtually maintenance-free service for over two years. This Anlin Co. installation is in conjunction with the California Oil Co. refinery at Perth Amboy, N. J. It is rated at 35 tons per day and produces extremely pure sulfur at yields well in excess of 95% at a wide range of thruput and feed composition.

Delivered as a complete package, the AMES furnace saves installation time and costs. The AMES boiler-burner unit combines the conventional dutch oven and separate waste heat boiler into one compact, automatic unit. Hence, first cost as well as operating costs are greatly reduced. Since no extensive foundations or housings are required, it provides a very flexible installation. The units are available in a wide range of sizes to suit your process needs.

Whatever the scope of your sulfur recovery operations, it will pay you to investigate the new AMES units. For complete facts on this phase in sulfur recovery, contact your nearby AMES dealer, or write direct to:

50 years ago

December 20, 1909

Gypsy Oil Co. (Gulf) gets into the lively development play under way in Oklahoma's new Preston field, in Okmulgee County, with purchase of one-half undivided interest with Iron Mountain Oil Co. in 400-acre lease block. Deal calls for starting seven wells immediately.

Largest ocean-going oil barge "Tulsa" launched at Port Richmond, N. Y. New vessel built for The Texas Co., to serve refined-oil trade between Texaco's Port Arthur refinery and terminals on Gulf and Atlantic coasts. It will carry eight grades of oil and miscellaneous packaged freight. It has steam power to operate pumps, anchors, and sails.

Oklahoma Pipe Line Co. starts work on 8-in. oil pipeline from Glennpool field on Midland Valley Railroad, south of Tulsa, to connection with Standard Oil Co.'s new line from North Louisiana to Baton Rouge.

25 years ago

December 13, 1934

New discovery by Mountain Fuel Supply Co. gives old Hiawatha gas field, in Moffat County, northern Colorado, its first oil production. Pay is in 2,300-ft. Wasatch sand. Hiawatha field, productive of gas from 1,700-ft. sand since 1925, is important source of supply for Mountain Fuel's Southwest Wyoming-Utah gas system.

Drilling through 2,000-ft. section of heaving shale by Pure Oil Co. in its No. 2 Stewart deep test in Louise field, Wharton County, Texas Gulf Coast, sets new record and marks significant progress in overcoming one of Gulf Coast's greatest deep-drilling problems. Section, topped at 6,400 ft., successfully cased off.

10 years ago

December 14, 1949

Scurry County, Texas, proclaimed world's most active oil area. More than 140 rigs, an increase of nearly 75 within 2 months, now are working in county's new reef fields with drilling being extended to adjoining counties along trend.

The Texas Co.'s first mechanical power rig on the Louisiana Gulf Coast goes into operation at Lake Barre, in Terrebonne Parish. It is the largest barge-mounted diesel-powered drilling rig in the world.

Peoples Gas Light & Coke Co. reveals plans for 1,400-mile, 30-in. gas line from lower Texas Gulf Coast fields to Chicago area. Capacity of line at 585,500 M.c.f. daily is country's largest. Project is first to bring Gulf Coast gas to Chicago area.

JOURNALLY SPEAKING

Mr. Pipeline Engineer

Death this month claimed an outstanding pipeline man and Journal author. His passing was duly chronicled in the obituaries of the Big Yellow Book.

But William G. Heltzel, who died of a heart attack December 3 at the age of 64, was more than an outstanding pipeline man. He was a pioneer in two fields—the technology of pipeline hydraulics, and the difficult art of simple technical writing.

Through such different accomplishments, he had a profound effect on his industry.

Heltzel, beginning in 1926, for many years was a widely read Journal author. Over the years, we've received more requests for reprints and photostats of Heltzel's pipeline hydraulics articles than for any other material in the field.

Furthermore, while he was not an inventor, he could grasp ideas of significance proposed by his associates and push them for testing and practical application. His code of ethics dictated that he buck the early-day practice of secrecy in the oil industry and share his knowledge with other engineers.

His interest in pipeline hydraulics began before 1920, when he went on a 2-year assignment with a Sinclair Mexican affiliate. Methods used then for designing pipelines he recognized were erroneous.

On his return, he explored scientific hydraulic literature in the library of his alma mater, the Carnegie Institute of Technology. There he studied the laws of mathematics and physics governing the flow of fluids. The next problem was applying them to pipelines.

Through bulldog tenacity and persistence, he got permission to use Sinclair's new Teapot Dome line for experiments in 1923 and 1924, to get basic data needed for applying known laws for rational design of oil pipelines.

It was in these experiments that he determined the relationship between the friction coefficient (transmission factor) and the dimensionless quantity known to engineers as the "Reynolds number."

Through this work, and Heltzel's articles, came concepts now basic to pipeline design.

In his writing Heltzel showed the careful study he gave to clear statement of technical matters. His numerous "Trend in Practices" articles could be understood at rural pump stations and in company offices.

Sinclair Pipe Line gave him the chance to carry out projects which meant much to him. But until 1930 he had no title except engineer. Sometimes, even in 1930, he did not have an office—not even a desk.

But with the change in ownership and management to Stanolind Pipe Line Co. in 1930, he immediately became vice president and, later, also general manager. He stayed with Stanolind until he became a consultant in 1946.

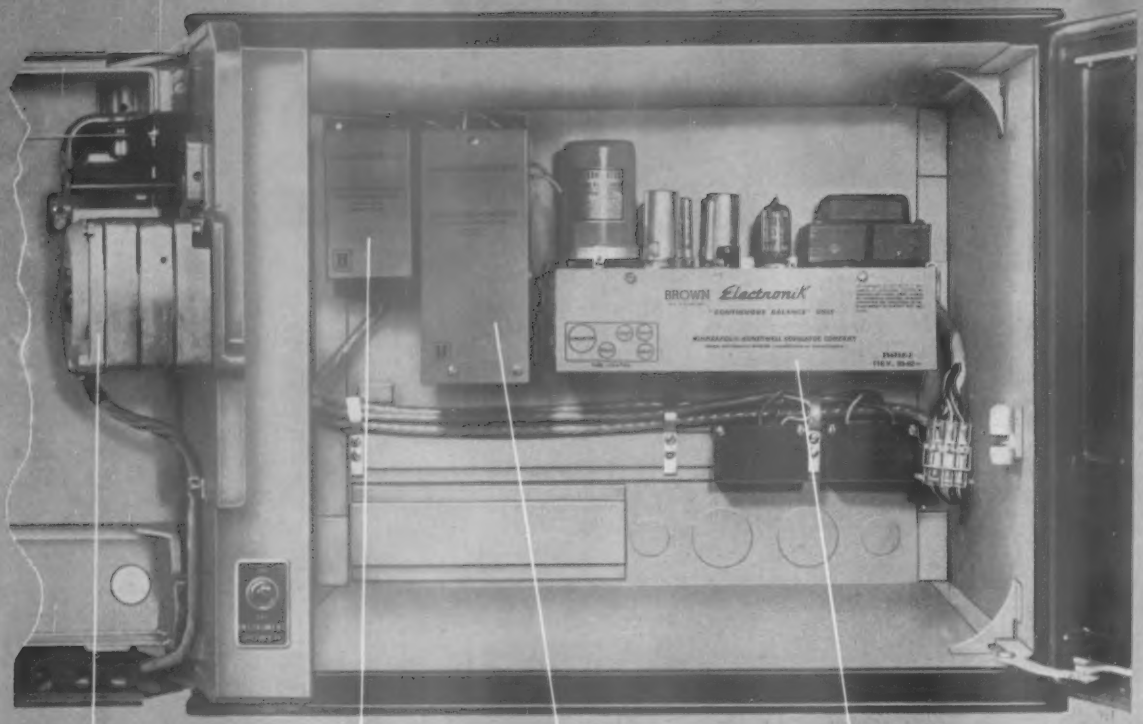
Heltzel was exacting of himself and others in striving for increased efficiency. At the same time he felt that efficient operations were not only profitable but good for the men who worked with them.

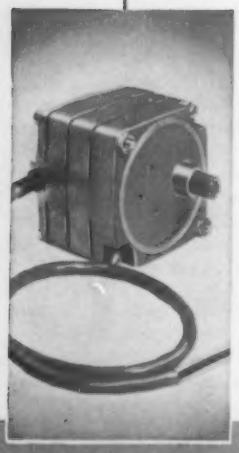
More than for his accomplishments in technology and management, Heltzel is probably now valued more highly for his goodness, thoughtfulness, and readiness to assist those who had problems he could help solve. Those of us who knew him realize that in his quiet way he was our teacher on many occasions.

Perhaps only a bachelor, as he was, could have carried through the program he set for himself in pipeline hydraulics. He took a fatherly or brotherly attitude toward the industry and his close friends. We were all a part of his family.

Bill Heltzel lived as one dedicated to the highest ideals of the engineering profession. Perhaps this is why we now hear him called, Mr. Pipeline Engineer.

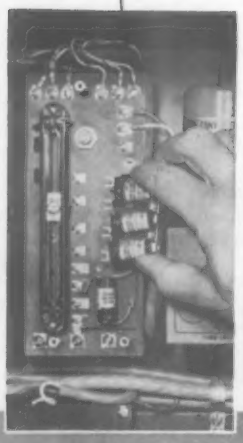
—Paul Reed.





Servo Motor has sectional housing, leakproof oil wick, printed circuits for simplified servicing. Any major part can be replaced in 2 minutes.

Constant Voltage Module—Uses Zener diodes and an ambient temperature compensator to replace standardizing mechanism.



Measuring Circuit Module—Contains easily-changed range spool panels and vernier adjustment. Range is changed simply by replacing screw-clip panels of fixed resistors.

Amplifier Module—Quick-connect design permits fast, easy removal for servicing and replacement. Circle shows quick connect plug.

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New modular design...

makes *ElectroniK* potentiometers easier to use and maintain

Now, four great new features add new operating and servicing ease to all *ElectroniK* circular and strip chart potentiometers.

- **New servo and chart drive motors are sectionalized so that any major part can be replaced in two minutes.**
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Now, modular design is combined with the traditional precision of *ElectroniK* potentiometers, to give you a greater value than ever in accurate, dependable measurement and control.

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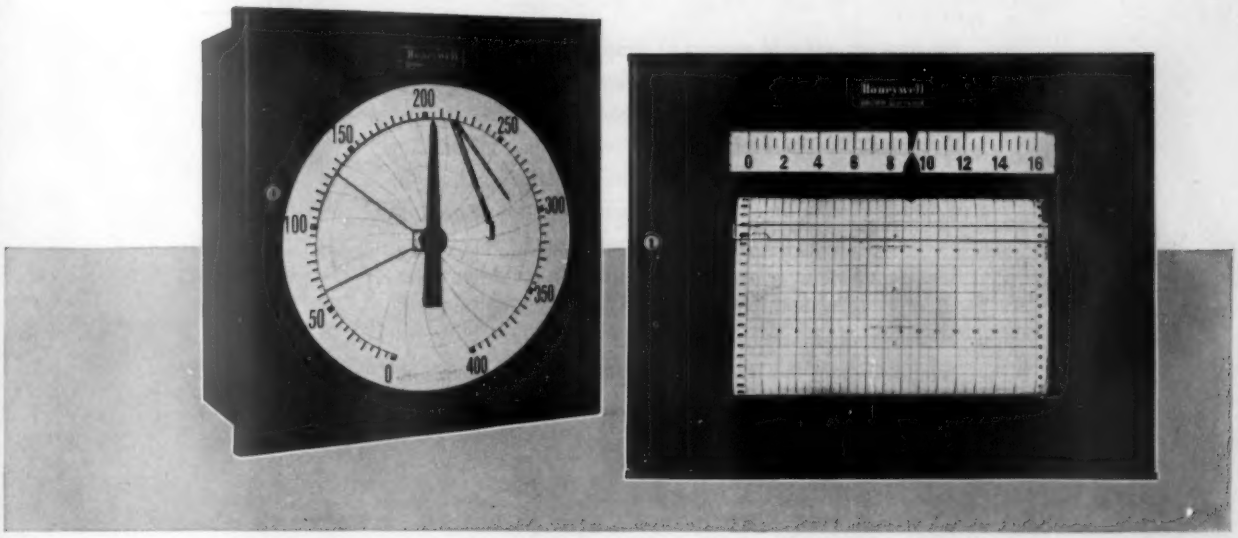
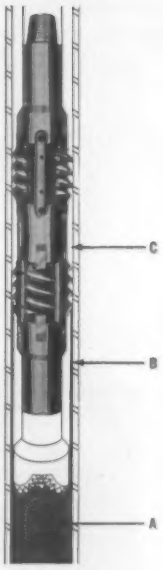


your WELL'S FUTURE LOOKS GOOD when the "WORKING SURFACE" of the CASING is CLEAN!



A – Cement to be drilled out.
B – This thin cement sheath, which remains after the bit has passed, often interferes with future operations.
C – Cement sheath and ALL other obstructions removed by the Baker ROTO-Vert Casing Scraper. The vital I.D. of the casing is left clean and smooth, safe for all future down-hole operations.

It's simple and inexpensive to run a Baker Casing Scraper just above the bit when drilling out cement, or following perforating operations, to provide a bright future for your well.

No obstructions will remain to cause premature setting of close-tolerance tools. Rust, mill scale and paraffin will be scraped away, and there will not be any sharp burrs to slash and ruin swab rubbers or affect the performance of packing elements on testers, packers and cement retainers. Even the thin, brittle cement sheath which prevents the slips of pack-off tools from gripping the casing, are scraped away.

Thousands of runs have proved the Baker ROTO-VERT Casing Scraper to be both positive and safe in cleaning up casing I.D. easily and at low cost.

Available from the Baker Servicepoint in your area, on a rental basis.

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This time the industry looked good in Washington

THE OIL INDUSTRY is frequently criticized—and criticizes itself—for botching its public relations and public appearances in Washington. Somehow, try as it may, it often appears to put its worst foot forward.

It seems appropriate, therefore, to call attention when the reverse occurs and a job is done exceptionally well.

Dr. Richard Gonzalez, of Humble Oil & Refining Co., and Scott Lambert, of Standard Oil Co. of California, did such a job when they participated recently in a panel discussion of percentage depletion before the House Ways and Means Committee.

The industry has a right to be pleased with the representation it received that day. Gonzalez and Lambert were an able team.

Their presentation deserves a close look because it could well serve as a model for future oil industry appearances before other congressional committees or government groups.

IN THE FIRST PLACE, they obviously were well prepared. They not only knew their subject as it applies to the industry, but also how percentage depletion fits into the larger pattern of the nation's economic structure, growth and welfare.

This not only enabled them to present their case fluently, but to respond promptly and fully to questions put to them by the committee. And they were more than able to hold their own in exchanges with the professors who were on the panel with them.

They were never vague or evasive or indecisive. As a lawyer who listened put it, they stood up mighty well under cross examination.

Some share of the credit for their preparedness should go to industry representatives who worked long hours with Gonzales and Lambert in getting ready to meet any eventuality. At any rate, the two certainly were ready.

MOST IMPORTANT OF ALL, it appeared, was the attitude they displayed and the atmosphere they created. They never seemed to be on the defensive, nor apologetic for the industry. They did not plead nor demand. They were not belligerent, intolerant, or impatient. Instead, they discussed the issues in a calm, straight forward manner.

It is difficult to believe that any who listened could help but have a better understanding and appreciation of percentage depletion—and a better understanding and appreciation of the oil industry.

This does not mean, of course, that the threat to percentage depletion has ended or that attacks on the oil industry will cease.

But it does stand to reason that if the industry continues to send to Washington men of the caliber of Gonzalez and Lambert—and to give them the cooperation it gave these two—oil will gradually find an improving climate in the nation's capital.

FARGO TOWNSITE UNIT WELL #2. All four wells operated by Mr. Moore are equipped with Bethlehem pumping units, Bethlehem sucker rods, and Bethlehem Beeline bottomhole pumps.

Fifth year for X-2 rods in four Rex R. Moore wells

Bethlehem Rod Package Handles Easily

Bethlehem Sucker Rods come securely bundled in an easy-to-handle unit package containing 80 or 100 rods. Rods rest on grooved spacers which prevent individual rod movement, protect rods against damage. Special wrench can be furnished for opening bundle.

Rex R. Moore operates four wells in the Fargo Townsite Unit Field, Willbarger County, Texas. In November, 1954, he installed strings of Bethlehem X-2 rods in these wells. Three of the strings are made up of $\frac{5}{8}$-in. X-2 rods, 3,950 ft long. One string consists of 3,975 ft of $\frac{3}{4}$-in. X-2's. All four wells produce 41-gravity oil from the Lower Canyon Sand Formation. Production varies from 30 to 55 bpd. The rods have never been pulled, since not a single rod has failed to date.

The Bethlehem X-2 rod is ideal for medium pumping duty in non-corrosive wells, as well as in wells which are effectively inhibited. Made from top-quality carbon-manganese steel, it is carefully normalized to provide uniform mechanical properties.

In addition to the X-2 rod, Bethlehem produces three grades of alloy steel rods, plus a full line of accessories. There's a Bethlehem rod to meet virtually any pumping condition or corrosion problem. For complete information, just get in touch with your nearby Bethlehem distributor.

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Coal Aims to Undermine Oil's Markets

• Coal men are exerting political pressure from the state house to the White House to win support. And there is a big difference in their approach to government—they don't mind asking for help in solving their problems.

THE NATIONAL Coal Policy Conference, organized only this year, has already drawn clear-cut lines of attack for its campaign to win markets at the expense of oil and gas.

There can be little doubt that coal means business, and that it is going to spend a great deal of time, effort, and money to try to achieve its goals.

The coal drive will involve use of political pressure, economic pressure, aggressive public relations, and a program of self-improvement.

Joseph E. Moody, president of the conference and president of the Southern Coal Producers' Association, spelled out some of coal's plans recently at a meeting of the Coal Mining Institute of America.

Other plans of the coal industry have been made apparent through its stepped-up efforts in Washington. Some of the moves are already under way or are being actively planned.

Political strategy . . . Coal will make continuing efforts, led by coal-state congressmen, to force reductions in residual fuel oil imports into Districts 1-4.

Coal will use political pressure wherever possible at federal, state, and local government levels to bring about more use of coal by governmental and other public institutions.

And the industry will continue to hammer away at the Federal Power Commission and Congress to limit the use of natural gas by industry.

It would be a mistake for the oil industry to try to underestimate the potential of the coal industry's political moves, for already coal has made rapid advances.

In the past session of Congress, for example, it pushed through Congress a bill to establish a coal research commission which would plan major research projects. President Eisenhower vetoed this bill, but now the Interior Department, apparently at the administration's suggestion, is seeking substantial funds for coal research in its next fiscal year budget.

Furthermore, the industry almost succeeded in pushing through a resolution which would have established a joint congressional committee to study the nation's natural resources and recommend a national fuels policy.

To many, this would have meant a long step toward end-use controls.

The resolution passed in the Senate and seemed headed for passage in the House when it was delayed in the House rules committee and did not reach the House floor for a vote.

The coal industry has already made it clear that one of its prime objectives during the upcoming session of Congress will be to get House action on the resolution.

Economic strategy . . . In addition to using political weapons, the industry clearly plans to put economic strategy to use whenever possible.

An example which the coal industry itself cites concerns railroads.

Since coal is shipped principally by rail (whereas more and more petroleum is being transported by pipeline and tanker), coal people have bluntly told the railroads they should use more coal and encourage its use by others.

As a result, some coal-carrying railroads who are members of the Coal Policy Conference have instituted "reviews" of their policies and actions in the light of coal-industry objectives.

For instance, some are turning to coal as the fuel for heat and power at their installations. A coal-industry official reported that "some of the railroads found that coal was being displaced by oil and gas in their own facilities, even though coal was cheaper and better. Now coal is given the preference."

A conference official also reported that one big railroad has begun a program promoting school consumption of coal. The rail line "discovered" an efficient and cheap automatic coal stoker and put that equipment into some 30 schools in one area.

"This project is only a few weeks old, but pretty soon thousands upon thousands of additional tons of coal will be consumed because of it," the official said.

Public relations . . . An important part of coal's over-all program—and frequently linked with the political and economic moves—is the new emphasis being given to public relations.

Coal sees the wisdom of convincing the general public, as well as Congress and the Administration, that coal has been getting the short end of the stick even though it is the nation's largest source of fuel energy.

It will stress the theme that it isn't after any special treatment but only wants an "even break" with competing fuels. The complaint implies, of

What Is the NCPC?

THE NATIONAL Coal Policy Conference is an organization formed last spring by the coal industry and allied interests.

Its members include coal operators, the United Mine Workers, coal-carrying railroads, coal-burning utilities, and the manufacturers of coal-mining equipment.

Its objective is to promote the interests of the bituminous coal industry.

It has already launched a vigorous, apparently well-financed, campaign to win public and government approval of policies which would help the industry become more competitive with oil and gas.

Coal has suffered while oil's demand has grown

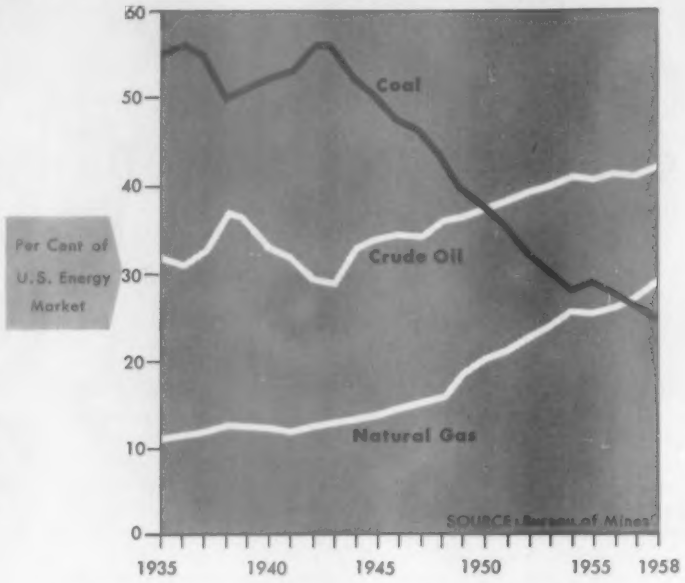
OIL AND GAS are capturing more and more of the nation's energy market while coal is moving in the opposite direction.

In the 13-year period from 1945 to 1958, coal's share of the U. S. energy market has dropped from 50.7% to 24.4%. While coal's market has shrunk to half its size during this period, oil's share of the market has increased from 34.1 to 42.3%. And natural gas has made even a bigger gain—from 14.1% in 1938 to 29.5% in 1958.

Coal lost its position as the nation's No. 1 fuel in 1951. In that year, oil served 37.9% of the market compared to coal's 35.8%. And 6 years later, natural gas surpassed coal by serving 27.8% of the market compared to coal's 27.1%.

The biggest market lost by coal resulted from railroads switching from coal to diesel fuel. During the 10-year period from 1948 to 1958, the demand for railroad coal tumbled from 120 million tons to 17 million tons. Oil has also grabbed a big part of the home-heating market from coal. Gas is taking this market from oil.

Coal has offset part of its market loss by selling more coal to electric utilities. The electric-utility market for coal has jumped from 70 million tons in 1948 to 140 million tons in 1958—a 100% increase.



And coal men are banking on a growth in electrical home heating to gain future markets for their product. The coal industry also sees a big potential in the steel industry's demand for coking coal and the cement industry's use of coal for its kilns.

These coal men are active today pushing political, economical, and public-relations programs in hopes of reversing the trend of the last 20 years and swing more of the energy market back to the coal mines.

course, that oil and gas have managed to get special favors.

The line of attack on residual fuel import quotas is a case in point. In public statements, coal officials charge that cheap residual fuel from Venezuela is being dumped at below-cost prices on East Coast markets at the expense of the domestic coal industry, and that such "dumping" is made possible by high import quotas.

They consider this as a special favor for the importers because, they say, high resid stocks in Districts 1-4 and continued low resid prices are clear indications that more imported residual fuel isn't needed.

The "dumping" angle will also continue to get more and more stress in coal's attack on natural gas.

Here coal will seek to convince the public that it is being the goat, paying high prices for residential use of natural gas so that gas can be sold to industrial customers at a price low enough to force coal out of those markets.

The coal industry will also stress the theme that the price of gas is already climbing and that it will continue to climb rapidly because of the limits on natural-gas reserves. Meanwhile, coal is in such plentiful supply it can continue to sell at low prices through the decades ahead.

The image the coal industry seeks to project before the public is that the oil and gas industry is trying to block progress toward the nation's best utilization of its energy resources —and that the public will suffer as a result.

This approach is evident in the coal industry's push for congressional action to draft a national fuels policy.

Coal leaders say the formulation of such a policy is essential to the nation's future and that opposition by oil and gas interests "is the result of a most curious process of reasoning."

Clearly, the coal strategy is to leave the implication that whereas its industry is perfectly willing for Congress to map a fuels policy for the nation's good, the oil and gas industry opposes such a move for fear it will lose markets.

Oil put on spot . . . A spokesman for the coal industry has made this charge: "To oppose the study itself is like taking the Fifth Amendment. It indicates that the opposition has something to hide."

As a part of its drive to create a favorable public image for coal, the coal industry has been busily cultivating magazine and newspaper publishers, editors, and writers as well as television and radio commentators.

In a sense, the coal industry's present drive is a second step in its efforts to shake off its doldrums and become a vigorous competitor.

The first step was a move to modernize and improve its facilities, improve its efficiency, increase its research, and revitalize its top-level management.

Undoubtedly, the industry has made substantial progress in that respect. Thus, it has now reached a stage where it feels it needs to sell this "new" coal industry to the public. And this program, although still young, shows signs of increasing strength and vigor.

The oil and gas industry is likely to become increasingly aware of this fact.

More Residual Imports Due Under New Quotas

• Residual allocations would have been higher if coal hadn't protested so strongly. District 1-4 crude quota is increased slightly, but the finished products flow will remain the same.

HIGHER residual fuel-oil quotas will feature the imports program during the first half of 1960.

The residual fuel increase, applying to District 1-4, will be 425,000 bbl. daily, an increase of 62,000 bbl. daily over the current quotas.

Originally, Interior Department officials had recommended an increase of 100,000 bbl. daily, but it is understood that strong objection from the coal industry caused the administration to trim the planned increase.

The total for all products for all districts will be 1,529,943 bbl. daily, compared with 1,450,087 during the present period.

For District 1-4, crude allocations will 718,087 bbl. daily compared with 682,707, and the quota for finished products will be 76,631 bbl. daily, the same as at present.

In District 5, crude and unfinished oil quotas will be 220,095 bbl. daily, a reduction of 13,212 from present levels. Finished products will be 6,753 bbl. daily, no change from the current period.

Other principal changes include:

... Canadian crude. All exempted crude imports from Canada into District 5 will be included in domestic supply picture, thus reducing slightly the amount available for quotas from other countries.

During the current allocation period, only 23,000 bbl. daily of the Canadian crude was included in figuring domestic supply, but actual Canadian imports into District 5 from Canada were almost 50,000 bbl. daily.

... Newcomers in products. The President authorized the Oil Imports Appeals Board to consider applications from companies who heretofore have not been eligible for product import quotas.

As the program was originally set up, product importers were limited to those who had a record of imports in 1957. This closed the door to newcomers.

The new provision, however, will open that door. The proclamation authorizing the change specified that such allocations would be given to those newcomers who could prove such action was needed to avoid "exceptional hardship in particular cases."

... Unfinished oils. Under the new program, the Secretary of Interior is authorized to vary the percentage of unfinished oils to be imported into District 5.

Under the plan up to now, the percentage of permissible unfinished oils is 10%. California refiners have objected, however, that this is unrealistic in view of their actual demands, and that it should be increased.

Even though the Interior Secretary has now been given authority to change the percentage, it was understood that he will consider this as standby authority and will change the ratio only after further study, if at all.

The proclamation fixing imports quotas was issued late December 10 over the signature of President Eisenhower. The changes in the regulation were put out by the Interior Department for release December 14.

The presidential proclamation clarified the authority of the Interior Secretary to adjust the maximum level of residual fuel or imports to fit changing conditions.

That was the intent of the original presidential proclamation last March 10 but some legal questions had been raised about it.

As it stands now, the Secretary will be able to change residual-fuel levels from month to month to meet changing conditions. Thus, if a residual-fuel shortage should develop during the coming months, Interior Department could boost the present levels.

Signal Starts Custom Blending in California

• Nevada experiment in multigrade gasoline marketing under Hancock brand proved success in only 4 months. It will expand fast now.

CALIFORNIA motorists for the first time can now choose from seven gasoline blends at the same service station.

Signal Oil & Gas Co. last week disclosed it has converted a Hancock service station in Placerville to a pump-blending operation.

And next month Signal will extend this multigrade marketing to other communities in central and northern California.

Signal first experimented with the blending-pump idea in Nevada. It opened eight multigrade stations there in mid-August and announced that it would watch results for 6 months before deciding whether to extend the use of the blending pumps (OGJ, Aug. 24, p. 39).

Last week, after only 4 months of observation, Signal made the first move in California. The Nevada experiment, it said, had been highly successful.

Precisely how successful the test was, Signal couldn't say. Before the test it had extensively refurnished the eight stations and had put them on a 24-hour basis. The company also had taken over direct management of the stations, which had been lessee operated.

Gallonage jumped, and apparently it jumped more than could be attributed to longer hours, better appearance, and company operation.

In California, operations will be a little different from those in Nevada.

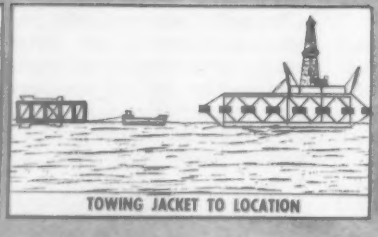
... Only seven blends will be offered motorists, instead of the nine sold in Nevada. Signal is dropping two "middle" blends, which were the least used in Nevada.

... Lessees will operate the California stations. Signal says it does not plan any direct company operation of its early multigrade stations on the West Coast.

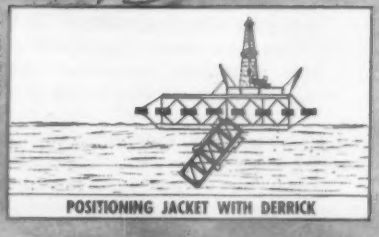
... Two names will appear on the pumps. Hancock will continue to use the "Econ-O-Blend" name introduced in Nevada. Signal's Norwalk stations will call the pump "Power-Blend."

ODECO Unwraps Its New

DRILLING is done through triangular-shaped jacket centered under derrick. Sketches show how jacket is installed.



TOWING JACKET TO LOCATION



POSITIONING JACKET WITH DERRICK

Drilling Island That Floats

Howard Wilson
Gulf Coast District Editor

A NEW CONCEPT in deepwater drilling has developed on the drawing boards of Ocean Drilling & Exploration Co. at New Orleans.

Because the proposed new floating device cannot be described as either a conventional drilling barge or a drilling ship of the CUSS I variety, ODECO has coined its own apt phrase for it —"drilling island."

The drilling island, protected by patent applications, is loaded with new ideas for sinking a well in waters 60 to 200 ft. deep and more—but two of these ideas make it genuinely unique:

. . . **The vessel** (if that's the word for it) has no hull as such but is kept afloat by a latticework of tubular members. The obvious advantage is that wave action is held to a minimum because the waves move through the vessel instead of against it.

. . . **Drilling** occurs at the center of buoyancy located within the inside angle of the L-shaped island. This cuts to a minimum vertical movement at the point of drilling.

Inventors of the drilling island are Alden J. Laborde, president, and Tom S. Graham, chief engineer for ODECO.

The two men estimate $3 to 4 million and a year of construction will be required to put their island to work. This cost is considerably less than many of the bigger offshore barges operating today.

The difference . . . ODECO points out that rigs so far developed for drilling in a floating condition have been converted from conventional ships, such as YF's, LSM's, and mine sweepers, and have done their drilling through a bay or opening in the hull, or over the side.

Position is held over the well bore by conventional anchoring methods.

This means that any moderately severe weather stops drilling because the ships present a large surface area to the waves and wind.

LaBorde and Graham have reasoned that the industry needs a drilling rig which (1) floats in a partly submerged condition, (2) has a high degree of wave transparency, (3) is nautically stable, (4) has a high degree of vertical stability under varying loads, and (5) is subject to a minimum change in horizontal movement under such varying loads.

The ODECO drilling island is designed to meet these requirements.

The "hull" . . . The drilling island will have a large number of symmetrically arranged hull elements which are actually hollow tubing for ballasting.

The width of each length of the "L" is approximately 350 ft. and the distance between two extended ends about 500 ft.

The vertical dimension of the structure is 100 ft.

The lower stringers are considered the primary hull members and are capable of supporting the island while it floats prior to partial submersion.

The stringers, as well as some of the diagonal bracing tubing, will be compartmented and provided with conventional pumps to ballast them for the correct degree of submerging. The stringers range in diameter from 8 to 14 ft. and the diagonals down to 4 ft.

The hull elements also contain a method for increasing the island's load-supporting capacity while partially submerged for drilling. This consists of about 24 cylindrical, hollow casings—buoyancy chambers — mounted in the diagonal tubing midway between the lower stringers and the top of the hull. During drilling, these would be half-in and half-out of the water.

The chambers will be approximately 14 ft. in diameter and 10 ft. high and be inserted at intersections of the diagonals.

Drilling location . . . The drilling station is at the inside angle of the 'L", where the center of flotation and buoyancy is located.

With this arrangement, movements of the island under varying loads during drilling will be limited largely to the vertical — and these will be greatly limited by the hull design.

The vertical component resulting from angular change on the horizontal obviously will be held to a minimum because of the central location.

The derrick platform is a basic part of the island and is swung over the water at the inside angle. Connected by upward slanting bridge trusses, it stands 20 ft. above the deck of the island and 65 ft. above the water during operations.

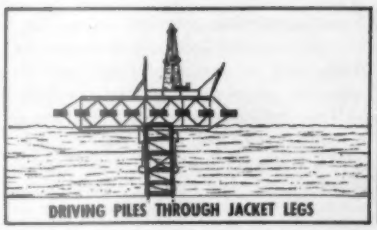
Placing the drilling operation in the 90° angle of the island has another important advantage over drilling through a slot or opening in the hull, as used by conventional floating vessels. The operator can readily separate the island from the well and its protective jacket and back away.

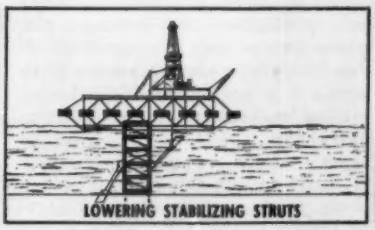
This is doubly important in the event of an accident. Should an anchor or cable fail, the island's chances of swinging free are considerably greater than if the drilling platforms were located in a narrow slot.

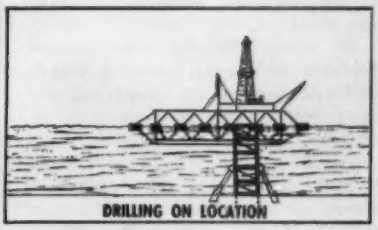
Drilling jacket . . . LaBorde and Graham contemplate drilling will be through a jacket installed with the use of a crane aboard the island itself.

The jacket floated to the location and set in place by crane-driven pilings.

The jacket will be a triangular


DRIVING PILES THROUGH JACKET LEGS


LOWERING STABILIZING STRUTS


DRILLING ON LOCATION

structural frame shaped generally to fit within the angle of the island. Design of the jacket permits three wells to be drilled and confines the conductor casing for each within a circle 12 ft. in diameter.

The circular enclosures are sufficiently large for convenient operations and will give the operators a point of reference should horizontal movement of the island become excessive. If it should become necessary to separate the island from the jacket, the circular structure will serve additionally as a support to the pipe and blowout preventers.

ODECO also has a method for keeping the jacket erect while pile driving in deep waters. This consists of stabilizing struts which extend outward from the jacket and act as additional legs resting on the ocean floor.

Other features . . . Because of its unusual shape, the drilling island is designed to separate into two parts for long tows. Each part would be nautically stable.

The overhanging drilling platform and bridges would be skidded back to the main deck for the ride. By moving thusly, the island could slip through narrow canals and locks.

At the drill site, it will be reassembled and set in place by nine anchors. Three anchors will extend out from each of three points — the two ends and outward portion of the angle.

Because lateral movements of the base structure are held to a minimum, this anchor system is considered sufficient to hold the island in place under severe storm conditions.

Machinery space will be located on deck within the angle. Beside it on one side will be the mud pits and mud storage and on the other side the pipe racks. At one end will be the helicopter deck and at the other end the crew's quarters.

The big advantage . . . ODECO has not yet contracted to build its drilling island.

But the inventors believe they have designed a piece of deepwater drilling equipment which should answer the industry's needs for structural stability in the uncertain offshore waters of the world.

By using a floating vessel in conjunction with a separate jacket, ODECO believes its island will cut costs below those of giant self-contained drilling barges that suffer from depth limitations and are expensive to move. The drilling island should be almost as economical to operate in waters 200 ft. deep as in those of 60 ft.

Better Results Are Coming

• Chemical engineers are told how to cut fuel-oil output while boosting gasoline yields, to minimize poisoning of catalyst, and to use boiling ranges to select feed stocks.

KNOWLEDGE gained in the last couple of years about catalytic cracking will make that processing tool much more flexible in the future.

For some plants it means a longer on-stream time. For every refiner it offers a balanced output of products tailored to his marketing problems.

What's new in cat cracking was outlined last week before the American Institute of Chemical Engineers in San Francisco. Eleven speakers appeared in a symposium. Their studies show, they said, that:

. . . **Metal contamination** of catalysts can be minimized by careful operation and design of conventional atmospheric and vacuum distillation equipment.

. . . **Boiling range** can be used to select feeds for desired product distribution and quality.

. . . **Feed preparation systems** can now maximize gasoline yields by recovering cracking stocks from residual fuels. This is easily done with furfural refining, propane deasphalting, phenol extraction, and deep hydrogenation.

Metal contamination . . . Nickel, vanadium, iron, and copper compounds contained in catalytic cracking feed stocks are deposited on the catalyst during cracking operations. These metals reduce activity and impair selectivity of the catalyst.

Poor selectivity means high yields of coke and gas, particularly hydrogen, and a lower yield of gasoline. Many fluid catalytic cracking units are limited in their coke-burning or gas-handling capacities. And as coke or gas yields increase in these units, the operator must either reduce conversion or throughput to stay within unit capacity.

An indication of metal contamination on the catalyst is the hydrogen producing factor (the ratio of hydrogen production to methane plus ethane production). The sensitivity of this factor to changing metals levels makes it a good basis for adjusting catalyst makeup rates and selecting feed stocks.

An example shows the bad effects of metal contamination. A fluid catalytic cracking unit was unable to operate at design rates when it was processing feed containing 1.0 ppm. nickel. Design was for 0.1 ppm. nickel. When processing the high nickel feed, catalyst consumption was high and capacity was limited, primarily by high gas make with high coke make a contributing factor.

The trays in the vacuum distillation column on the unit were altered to improve fractionation. These changes lowered the nickel content to 0.1 ppm. without materially changing other characteristics of the feed. With low nickel feed design capacity was exceeded.

Boiling range . . . Feed stock boiling ranges greatly influence catalytic cracking product yields and qualities.

Average feed boiling point can be used to predict gasoline octane, gas composition, conversion, and the major products of conversion.

Low-boiling feed is refractory but cracks to high-quality gasoline. High boiling feed cracks readily, producing large quantities of relatively low-quality gasoline. The boiling range of a recycle stock also influences product yields in the same manner as fresh feed. Control of recycle boiling range offers important flexibility in control of product distribution and unit heat balance.

Demands of the American market call for the selection of feed stocks based on high yield of high-quality gasoline. For the European market, however, the selection of feed stocks for catalytic cracking operations is more likely to be controlled by consideration of the middle distillate requirements.

Maximum possible extraction of straight-run distillates is made before feeding to catalytic cracking units. The lower boiling point fractions, being refractory, act as diluents in the cracking operation.

Feed-preparation systems . . . These can cut residual-fuel output to a minimum and, at the same time, recover valuable gas oils for catalytic cracking.

The marketing of residual fuels, already a difficult problem in some areas, is expected to become still more difficult in the future unless the amount of residual fuels decreases or new markets appear.

Too, seasonal shifts in product re-

From Catalytic Cracking Operations

quirements call for increasing gasoline yields at certain times of the year.

These various factors emphasize the need for increasing the preparation of gas oil for catalytic cracking feed. These four processes provide methods to achieve this goal:

... **Furfural refining.** This has long been used to prepare high-quality lubricating-oil stocks and distillate fuels. It has been successfully adapted to the task of increasing feed stock for fluid catalytic cracking units.

At the same time it upgrades feed stocks by recovering desirable components selectively that are otherwise lost in residuals. Commercial units are already producing high quality catalytic feed stocks and materially increasing gasoline production.

Furfural has a high solvent power for the aromatic fractions in an oil. Good yields of paraffinic stocks are obtained by treating submarginal oils with relatively small amounts of furfural.

Profitable cracking of heavy coker gas oils and low-gravity deasphalted oils is generally restricted by the heavy coke producing nature of these oils. Furfural rejects the undesirable compounds from these stocks, thus making them suitable for cat cracking.

... **Propane deasphalting.** This has been used for years to separate heavy lube-oil stocks from vacuum residues. Improved techniques and equipment now make it possible to recover large quantities of excellent virgin catalytic cracking feed from heavy vacuum residues. A marked reduction of No. 6 fuel oil results, particularly in the case of residues of low asphalt content and high content of oil boiling above 1,000° F.

The recovered deasphalted oil may be added to existing catalytic cracking feed to increase gasoline production. It may also be used to displace lighter fractions from catalytic cracking feed to enhance middle distillate production.

... **Phenol extraction.** This can be used on both cycle oils and virgin feeds. Currently used on catalytic cycle stocks, its benefits are now being recognized for treating virgin feed stocks. The raffinates from phenol extraction are more paraffinic and have less metal contamination than do the corresponding untreated oils.

The phenol extraction process is selective in concentrating aromatics in the extract phase. The raffinates from virgin feed stocks yield more gasoline than do the untreated stocks. Too, the highly aromatic extract may be sold profitably.

... **Deep hydrogenation.** Conversion of petroleum residues to high-quality cat cracking feed stocks can be made by deep hydrogenation in the 2,000 to 3,000 psig. pressure range.

The cracking stocks are comparable to virgin gas oils in their response to catalytic cracking. It is possible now with deep hydrogenation to do away with residual fuel production.

Deep hydrogenation of vacuum residue produces a light fraction of light distillates and a heavy fraction that is a good quality catalytic cracking feed.

When virgin gas oil is included in the hydrogenation charge a synergistic effect acts to give a hydrogenated residue of exceptional cracking quality. Hydrogenation becomes more attractive as the price of residuel fuel oils declines relative to crude and distillate products.

The deep hydrogenation process is different from hydrodesulfurization of sour gas oils. In hydro treating, relatively mild hydrogenation conditions are employed to remove sulfur compounds from catalytic cracking feeds with substantially no cracking.

Carbon-Dioxide Flood Gives Fastest Payoff

CARBON DIOXIDE and propane floods both will recover substantially more oil than conventional water floods or gas drives, but the carbon-dioxide flood will yield its oil faster.

This was one conclusion reached by L. W. Holm, Pure Oil Co., Crystal Lake, Ill., from his comparative studies of the two new secondary-recovery tools.

His report was given at last week's AIChE meeting in San Francisco.

A promising method for improving the efficiency of water floods also was given during the two petroleum sessions devoted to miscible-fluid displacement. This involves the use of an air drive after a water flood.

Holm carried out his experiments with both sandstone and dolomite cores. A West Texas stock tank oil and refiner oils were used as oil in place. Holm followed injections of carbon dioxide with carbonated water and followed propane with methane.

Using the two solvent flooding processes, Holm obtained recoveries of 60 to 80% of the original oil in place. This compared with recoveries of 25 to 45% by conventional gas drive and water flooding. Holm also reported that regardless of the flooding process, less oil was recovered from the dolomite cores than from the uniform sandstone cores.

Relatively small amounts of carbon dioxide were used in the tests, followed by carbonated water at pressures above 900 psi. Less total fluid injection was required for the carbon-dioxide process to obtain the increased oil recovery than was needed for the propane-methane process. However, the amount of carbon dioxide required would be greater than the amount of propane needed for a given field application, Holm declared.

The high oil recoveries obtained by carbonated-water flooding, Holm said, were due primarily to the comparatively high mobility ratio of the flood. This type flood also can increase injection rates in carbonate rock and increase oil recovery by blowdown.

Water plus air drive—Applying an air drive upon completion of a water flood will give additional oil, according to laboratory tests carried out by F. W. Cole, J. V. Cowan, and M. L. Jackson at the University of Oklahoma.

They were working with radial cores to determine the displacement efficiencies of various sizes of pentane slugs followed by a water drive.

They found that applying an air drive after the water flood resulted in an additional oil recovery of about 10%. This was evident in all the water floods undertaken, including those where the water flooding was preceded by a miscible flood.

Reason given by the authors was the location of the residual oil phase following a water flood:

"In strongly water-wet cores, the residual oil saturation is presumed to be in the larger pore spaces where it would be susceptible to displacement by a nonwetting displacing fluid, such as air."

Roosevelt Opens New Attack on Marketing

• Hearing questions coercion in TBA sales, but it could move toward legislation which would divorce marketing.

REP. James Roosevelt (D.-Calif.) resumed a drive last week which could lead eventually to an effort to draft legislation divorcing marketing from major oil company operations.

The vehicle Roosevelt used was a public hearing on marketing practices, clearly aimed at showing that the majors "coerce" their leased-station operators into buying a particular brand of tires, batteries, and other auto accessories.

The three-way hearing last week by a House small business subcommittee, which Roosevelt heads, was limited to practices which may restrict competition in TBA sales. But Roosevelt has indicated that other oil marketing practices will be probed later.

He set the tone for the hearing in his opening remarks in which he recalled that the subcommittee had held similar hearings 2 years ago.

He said it was decided at that time to discontinue the hearings for a time to give the major oil companies an opportunity to "clean up" any coercive practices. Some immediate improvement was noted after the 1957 hearings, Roosevelt said, but before long the complaints began to mount again.

Laws needed? . . . He said the response to recent questionnaires sent out by his subcommittee indicated that the practices were as bad if not worse than before the 1957 investigation.

One of the questions he was putting to witnesses last week was whether or not the witness felt that it would require some form of legislation to clear up the problem.

He was clearly delighted when one witness who had not favored divorcement legislation in 1957 said he now feels that such action may be necessary.

The witness was Victor L. Toft, president of the Automotive Service Industry Association and recently named "the automotive man of the year."

The members of the association which Toft heads are largely independent wholesaler dealers of TBA supplies and equipment.

Concerning his change of heart on divorcement legislation, Toft said: "I've had some rude awakenings since 1957. I have reached the reluctant conclusion that only legislation would correct the existing abuses."

The gist of Toft's complaints was this:

Independent TBA wholesalers have been constantly and increasingly losing business to service stations because of the "pressure" major oil companies put on the station operators to buy their TBA items from a supplier approved by the oil firm.

By contrast, Toft claimed, TBA wholesalers have not lost business to independent stations owned by the operator.

Toft implied that the latter was in a position to make his own choice of merchandise whereas the operator of a leased station was more subject to pressure from his oil supplier.

Credit a factor? . . . Rep. Tom Steed (D.-Okla.), a member of the subcommittee, wondered if the increased use of credit cards isn't a factor in the problem of coercion.

He noted that since the major oil companies are responsible for the credit involved when a customer buys something at a service station, it would seem likely that the major would prefer limiting the credit card use to items on which the major has a working arrangement with the manufacturer.

Toft agreed, saying that some majors tell their dealers not to honor credit cards when the purchase is for some TBA item not handled by the major.

In other discussions about possible legislation, it was brought out that laws already exist which prohibit unfair marketing practices.

However, Roosevelt said that effective policing action by the FTC and the Justice Department would require huge staffs, and that the problem might be handled better by new legislation.

Some observers felt that Roosevelt was using the hearing to test the present climate for proposals to restrict marketing practices.

His decision on whether to press forward may hinge, therefore, on the reactions which develop as a result of the current probe.

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watching WASHINGTON

Clyde La Motte

• Military supply creates some problems . . .

A FREQUENT TOPIC of conversation between military men and oil-industry representatives is the growing gap between the trends of industry growth and the trends of military needs.

In some instances, the direction of the industry is almost the reverse of that which the military would like to see it take.

For instance, the industry has been turning to bigger and bigger tankers, obviously because it is finding that oil can be hauled cheaper that way. But the military would rather have smaller vessels, and more of them.

The military viewpoint is understandable. It needs oil supplies at many locations around the globe. Many of these installations do not have ports or facilities big enough to handle the supertankers. Nor do they have the storage.

Furthermore, the military naturally tries to keep what storage space it has as nearly filled as is feasible, because

Aneth Production Curbs Asked to End Waste

• Superior wants to encourage pressure-maintenance by reducing the basic allowable and giving a bonus for injection programs. Company claims 22,500 bbl. of crude is being lost daily under present production practices.

SUPERIOR Oil Co. has placed before the Utah Oil and Gas Conservation Commission a production plan designed to halt underground waste in the Greater Aneth region.

Superior presented its conservation plan in a special petition to the commission following the recent hearings on new spacing patterns in Aneth.

The company opposed the 40-acre spacing request of Shell Oil Co. and instead asked the commission to take action on underground waste which it termed Utah's greatest current problem (OGJ, Nov. 16, p. 135).

Superior's plan involves:

... **Basic allowable** of 230 bbl. daily per well on each 80-acre tract. The present allowable is 350 bbl. daily per well.

... **Extra allowable** up to one-half the basic for water-injection operations.

... **Right to transfer** allowable from wells converted to water injection to other wells on the lease.

... **Daily gas limit** for each well of 800 cu. ft. per barrel of oil produced.

The argument . . . Superior attorneys say severe underground waste is occurring under present production practices in Utah.

They estimate that each barrel of oil currently being produced physically destroys more than one-fourth of a barrel of oil underground. The crude thus lost actually could be recovered with appropriate production measures, Superior contends.

The company estimates that with daily production of about 90,000 bbl. in Greater Aneth 22,500 bbl. daily is being lost underground.

Superior recommends pressure-maintenance steps should be taken immediately in the region and declared that the 40-acre request by Shell would slow down any water-flood operations by at least 3 or more years.

The petition describes the Aneth producing mechanism as solution gas-drive process. By experience with this process, engineers estimate a low ultimate recovery, ranging from 13 to 15% of the estimated 800 million barrels of oil in place.

Superior also set forth that the original solution gas-oil ratio of Aneth was below 700 cu. ft. per barrel. Current records show the field is producing with a ratio in excess of this average. This indicates equilibrium gas saturation is being exceeded. Free gas is flowing through the reservoir and is being preferentially produced.

The gas production results in shrinkage of reservoir oil and makes crude more difficult to recover by secondary operations.

Superior asked that its allowable plan be put into effect until a complete pressure maintenance program can be established.

The commission probably will act on the petition early in the year. It also is scheduled to resume hearings then in the Aneth spacing question.

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it doesn't want to get caught with its stocks down in an emergency. Ideally, therefore, it would like to have frequent servicing, in smaller quantities.

One solution, of course, would be for the military to build more port and storage facilities so it could make use of the bigger tankers. But there it runs into budget problems and a reluctant Congress.

From the military standpoint, the tanker problem may get worse before it gets better. It has been depending to a great extent on T-2 tankers, but most of these were built during World War II and are now generally headed toward the junk heap.

• Natural gas growth vs. more jet fuel . . .

THE RAPID GROWTH of the natural-gas industry poses another problem for the military.

The military isn't interested in more natural gas, but in more and more liquid fuels, particularly jet and diesel.

Military oil officials reason that as natural gas captures more and more oil markets, the growth of the oil industry will slow somewhat and its emphasis will shift even more to the output of gasoline rather than of the middle of the barrel products the military requires.

The military concedes that this isn't likely to cause it any major problems during normal times, but it fears that the trend does not properly prepare the industry for the sudden upsurge in the demand for "middle" products which an emergency would create.

Frankly, the military would like to see the industry adopt the theory of some oil economists that a larger share of oil and gas exploration and drilling costs should be assigned to gas (OGJ, Dec. 7, p. 82).

This move, military men figure, would tend to slow down the gas growth and stimulate oil activity by reopening more markets for "middle" products. This would encourage an increase in the over-all capacity of the oil industry, making it better equipped to face an emergency.

• Tighter product specs don't help . . .

THE MILITARY concedes that part of its problems are of its own making.

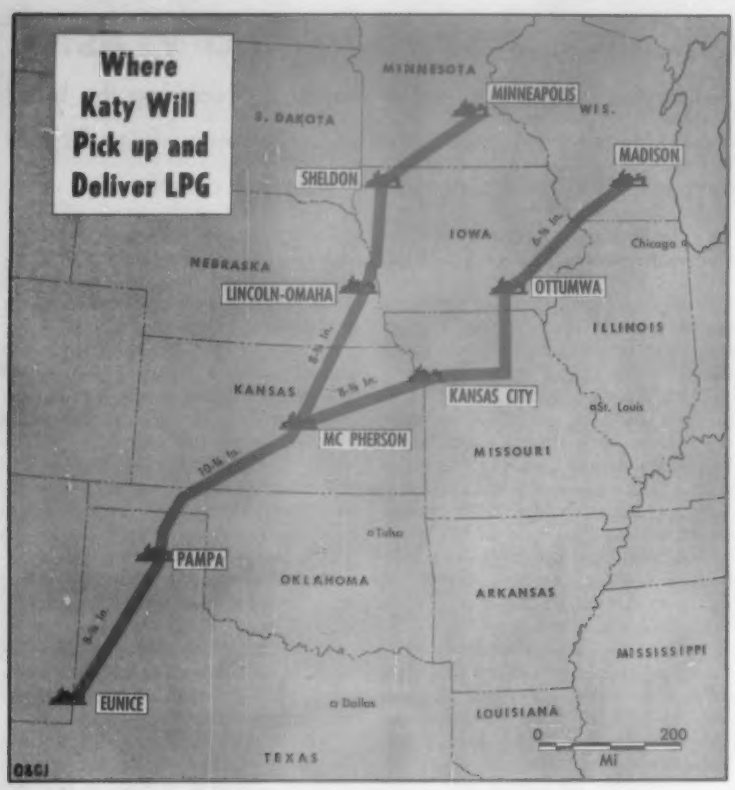
It has gradually tightened the specifications on the various fuels it needs, thereby narrowing the part of the barrel from which such products can be obtained.

It talks from time to time of a multi-purpose engine which could operate on virtually any type of fuel. Then, when the showdown comes, the military inevitably turns to the engine which gives the best performance—and this usually requires a fuel tailored for its use.

The oil industry naturally is interested in being in a position to meet whatever military oil needs arise. Aside from the nation's welfare, there is the fact that the military is the industry's No. 1 individual customer.

Even so, the industry obviously has to be geared primarily to a civilian economy and civilian needs.

The problem, hterefore, is how to keep the two needs —civilian and military—as nearly alike as possible so that both can be adequately met.



The new line will

- be the first common-carrier LPG line.
- be started this spring, possibly by February, and finished next fall.
- be of 10 and 12-in. pipe with branches 6 and 8 in.
- cost $60,000,000.

and it's another indication railroads are determined to stay in the transportation business—one way or another.

Katy to build 2,500-mile LPG system

An LPG pipeline system running from the Permian basin to Minnesota and Wisconsin will be built by Missouri-Kansas-Texas Railroad.

It is understood from major shippers that Katy has lined up more than 30,000 bbl. daily in potential business, which is enough to finance the line. The system will include about 1,500 miles of main line, plus extensive gathering systems connecting gasoline plants in West Texas, southeastern New Mexico, and the Texas Panhandle with the system.

Natural gasoline, butane, and propane will be moved as far as McPherson, Kans., refining area, the market for butane and natural gasoline. From McPherson, the line will fork with one branch going to Madison and the other to the Minneapolis-St. Paul area. The two branches are intended to carry only propane. None of the line will follow Katy's right-of-way.

Second bid succeeds . . . Katy has succeeded in putting together a financable project of this type on the second try.

The first effort was for a $100-million line from Houston to New York. The project was studied in conjunction with the New York Central Railroad. It fell through when potential shippers failed to give sufficient support to make the line feasible.

Then Katy switched to the plan on its own, aiming for the Kansas refining market and the North Central States propane market. This proposal proved to be more nearly suited to the needs of Southwest producers—the Little Big Inch, for example, already served much of the area which the railroads planned to supply with the line from Houston.

Several potential shippers signed "letters of intent"—not "ship or pay" agreements but indications of their intention to use the line if it would be competitive with other forms of transportation and would meet certain other requirements. Major shippers are expected to include Tuloma Gas Products Co., Skelly Oil Co., Texas Natural Gasoline Corp., and Anchor Petroleum Corp.

They have indicated strong initial interest in the project. And when it gets under way, Katy is expected to line up considerable "band-wagon" business.

Construction schedule . . . The engineering and construction-management contract reportedly has been awarded to Williams Brothers Co., Tulsa, which has done feasibility studies for the project.

The beginning of construction will depend on pipe delivery.

The aim is to complete the line to McPherson by midsummer. At that point salt caverns will be used for seasonal as well as operational storage. If the line is completed to that point by the target date, shippers will have adequate time to fill storage during the slack demand in summer to meet peak requirements during cold weather.

Katy plans to have the entire system finished in the fall.

Significance . . . Katy's venture is the latest indication that railroads are serious in providing transportation—by whatever means—in order to keep business that would otherwise be lost.

Southern Pacific Pipe Lines, Inc., has made a profitable venture of its products line from El Paso to Los Angeles. It has gained back some petroleum traffic which would naturally

go to a cheaper means of long-haul transport than rail.

The Permian basin-Wisconsin line will take away LPG rail business on long hauls between the producing area and the North Central States. But it will also stimulate local rail business along the pipeline route. And it will provide greater availability of LPG for this particular market, spurring further development of this already-good outlet for one of the fastest-growing petroleum products.

The line will also help to stabilize the price of LPG by contributing a market for more year-round business to smooth out the sharp peaks and valleys characteristic of LPG sales.

Depth Mark Is Set

. . . in Texas by Pure's new 16,264-ft. Galveston well.

THE PURE OIL Co. has completed the deepest producing well ever drilled in Texas.

The wildcat, a natural gas producer, was drilled to 17,051 ft. Production is from the Frio sandstone from 16,132 to 16,264 ft. It is in Galveston County, 10 miles west of Galveston.

The Houston Farms Development Co. No. 1 flowed at the rate of 1,540,000 cu. ft. of gas daily through a ⅛-in. choke. It also produced 35 bbl. daily of 50.7°-gravity natural gas condensate and 69 bbl. of water.

Extremely high pressures were encountered. Flowing pressure was 5,084 psi. and surface shut-in pressure was 9,300 psi. The well is centered in a 1,346-acre lease.

Before Pure's discovery, the production depth record in Texas was held by a 15,000-ft. gas well in the Puckett field of Pecos County. The Pure well is the fourth deepest producer in the U. S. The deepest is an oil well in South Louisiana, brought in at 21,443 ft. in 1956.

Gas Found in Cambrian

The first Cambrian production east of Kansas has been found in a well in Erie County, Pennsylvania.

The Russell McConnell 1 Borst in Conneaut Township flowed gas at a rate of 400 M.c.f. daily from a zone between 5,896 and 5,910 ft. Producing formation is the Gatesburg Upper Cambrian.

Ten wells have been drilled to or through the Gatesburg in Pennsylvania, but most had only salt water with an occasional gas show. The 1 Borst last week was shut down to acidize the Gatesburg.

Manning Urges Gas Exports

• Ultimate reserves will top 50 trillion feet, premier says. Shambaugh takes top post of drilling contractors.

FINANCIAL benefits to Albertans from export of natural gas far outweigh any possible domestic price increases, Premier E. C. Manning said last week in a major policy speech in Calgary.

He told the tenth annual convention of the Canadian Association of Oilwell Drilling Contractors that Alberta has already reaped some $936,000,000 from the development of oil and gas.

Provincial revenue from development this year could well reach the equivalent of $360 for every family in the province or $90 per capita.

Premier Manning said estimates on Alberta's gas supply are increasing. Latest estimates of the oil and gas conservation board indicate that in time proved reserves will exceed 50 trillion cubic feet of gas as against a conservative listing of 26 trillion in proven reserves at the present time.

In view of these future "astronomical figures" Alberta is reaching the stage where "man-made hurdles" to the export of gas can be removed.

Oil notes . . . Dealing with the oil end of the industry, Premier Manning made two main points:

1. Suggestions of the Borden Commission to increase use of Canadian crude oil should be translated into national policy so everyone knows where he stands.

2. An arrangement should be made for integration of U. S. and Canadian oil supplies with a distinction made between continental oil moved by pipeline and imported oil moved by tanker, in view of tanker instability in time of world disturbance.

S. W. Shambaugh, vice president and general manager of Reading & Bates Drilling Co., Ltd., has taken over as president of the Canadian association. He succeeds F. T. Glasscock, vice president of Pennant Drilling Co., Ltd.

Elected vice president of the association was R. H. Bullied, general manager of Cascade Drilling Co.

Northern Wells Await Winter

• Cold weather will kick off Northwest Territories tests on 1,224,000-acre spread. Home Oil is operator.

WITH ALL preparations complete, Home Oil Co., Ltd., is awaiting only arrival of cold weather to start moving equipment for its Celibeta Lake tests in the Northwest Territories.

Formerly known as the North Petitot area, the Celibeta Lake sites now being staked are 25 and 30 miles northwest of the Gulf States Petitot River 34-D well in northern British Columbia.

Ice bridges capable of holding light traffic have been completed across the Nelson and Petitot rivers. Colder weather will enable the bridges to be strengthened sufficiently to carry drilling equipment.

An area office has been established at Fort Nelson with Lloyd Stafford as drilling supervisor. J. H. Hamilton, assistant to the general manager of Home Oil, will be coordinator for the project.

The Celibeta Lake tests are on a spread of more than 1,224,000 acres farmed out by Canada Southern Petroleums, Ltd., Magellan Petroleum Corp., and Oil Investments, Inc., to the Home Oil-Signal-Kern County-Alminex-United team.

Two wells planned . . . The team agreed to pay $3,500,000 in cash and spend $3,000,000 over 5 years to earn a half interest in the huge spread.

An option on an additional 31,966 acres along the southern edge of the spread also was acquired and one of the wells now staked is on this tract. It is Home Signal C.S.P. Celibeta No. 1 and is 25 miles northwest of the Gulf States Petitot River gasser. The second site is 5 miles northeast of the first.

Contracts for drilling the two wells have been awarded to Brinkerhoff Drilling Co. and Perker Drilling Co. Tubular goods for the project have been stacked at Fort Nelson.

Home Oil is operator and will earn an interest of 12.5% of the project. Signal Oil & Gas Co. will hold 25%, Kern County and Alminex 5% each, and United 2.5%. Canada Southern will have a 37.5% interest, Magellan and Oil Investments 6.25% each.

Biggest Unitization Project Under Way

● Program designed to coordinate hunt for strat-trap pay in Green River basin of Wyoming. Drilling campaign is due to start in the spring.

A UNITIZATION program rated as the largest ever undertaken in the oil industry is in full swing in the Green River Basin of western Wyoming.

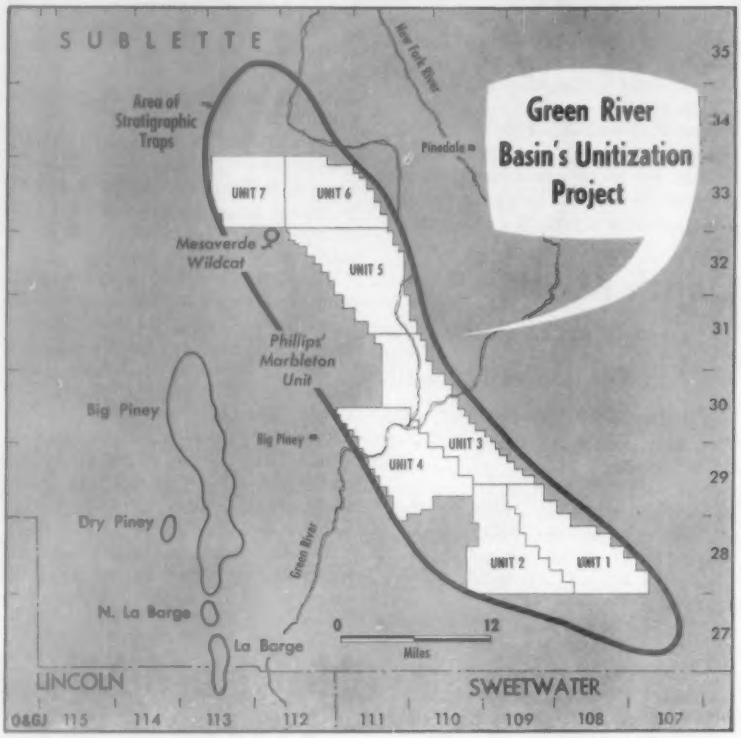
The project has the approval of both federal and state agencies. It is being spearheaded by Robert V. New, president of Green River Basin Corp., Chicago, which owns 61.8% of the 205,000 acres involved.

Object of the unitization is to coordinate exploration activities in a large area featured geologically by stratigraphic traps.

After unitization is completed, a series of wells will be drilled to depths and pay zones which already have made other areas of the Green River basin prolific gas producers.

The high hopes held for the project can be seen from this statement by Wyoming Gov. J. J. Hickey:

"We believe that gas is now doing to western Wyoming what oil did to West Texas. We have had some wonderful discoveries in the Green River basin. This is the biggest unitization project ever undertaken, and it may well be the key project to trigger the future greatness of Green River basin."



The project . . . Green River Basin Corp. currently is trying to sign up leaseholders in seven separate out contiguous units in Sublette County.

New says that approvals are coming in steadily and the outlook is most encouraging for complete approval soon. Other major acreage holders, besides Green River Basin Corp., are Pan American Petroleum, Phillips, Belfer Natural Gas, Gulf, Mountain Fuel Supply, British-American, and Carter.

The U. S. Geological Survey designated the seven unit areas after months of negotiations with Green River Basin officials. Some 80% of the land is federally owned with only 5.6% owned by the state and 13.7% owned in fee.

The entire 205,000 acres in the seven units compose one stratigraphic play. As soon as unitization is completed eight exploratory wells are planned to test the Mesaverde formations on each unit.

But even before that, Green River Basin Corp. is cooperating financially with Phillips in a Mesaverde wildcat on the Phillips' 58,000-acre Marbleton unit which adjoins the Green River Basin units. The Marbleton unit also is a stratigraphic play, and the wildcat will give both companies a chance to test the region.

The Phillips wildcat, located in the north half of Section 10, Township 32 North, Range 112 West, Sublette County, is drilling below 7,800 ft., with plans to drill to 11,500 ft.

The geology . . . Stratigraphic and structural geology involved in the units was mapped under the direction of George P. Zebal, exploration vice president of Green River Basin Corp.

The Green River Basin drilling plan ultimately includes:

. . . No. 1 Unit, totaling 30,470 acres, well with total depth of 13,175 ft. to test the Almond section.

. . . No. 2 Unit, totaling 29,285 acres, well with total depth of 11,100 ft. testing both Almond and Ericson.

. . . No. 3 Unit, totaling 34,978 acres, well topping Ericson to total depth of 11,775 ft. and testing Almond.

. . . No. 4 Unit, totaling 32,678 acres, well topping Rock Springs to total depth of 11,600 ft. testing Almond and Ericson.

. . . No. 5 Unit, totaling 31,308 acres, first well to top Ericson at total depth 11,725 ft. and testing Lewis and Almond; second well to top Lewis at total depth 11,200 ft. and testing the Lance.

. . . No. 6 Unit, totaling 24,460 acres, well topping Ericson at 12,500 ft. and testing Lance, Lewis, and Almond.

. . . No. 7 Unit, totaling 22,005 acres, well topping Rock Springs at 11,800 ft. and testing Almond and Ericson.

Zebal has been a field geologist for U. S. Vanadium Corp., The California Co., and American Petroleum Co. When New sold American Petroleum in 1952 to Columbian Carbon Corp., he took cash and Zebal. They then entered Wyoming where Zebal spent the next 7 years working up the intricate geology while New negotiated to put together leases and then form units.

Climax of their work should be this spring when drilling starts on the first Green River basin wells.

Fuel-Oil Ban: Boon or Bust?

• It was a great thing, say air-pollution officials. It was nothing, retorts oil group. Los Angeles supervisors take the conflicting reports under advisement.

THE LOS ANGELES County Board of Supervisors heard some sharply divided opinions on the effectiveness of the summer-months ban on fuel-oil burning in the county.

The Los Angeles Air Pollution Control District claimed it did everything expected of it—reduced sulfur dioxide in the air, reduced smog damage to crops, and increased visibility.

The oil industry said the benefits were "illusory" and the failure "nearly complete."

Rule 62 banned the burning of fuel oil in the county containing more than 0.5% sulfur from May 1 to October 1 this year. Next year the ban extends from May 1 to October 31.

In his final report to the supervisors at a special December hearing, S. Smith Griswold, director of APCD, cited these claims for the rule:

... **Improved visibility,** particularly around large industrial areas where fuel oil ordinarily was used.

... **Eliminated** crop damage caused by sulfur contamination in the air.

... **Cut emissions** of sulfur dioxide to the air from 318 tons daily to only 15 tons daily during the ban. Also eliminated were 45 tons of oxides of nitrogen and 14 tons of aerosols daily.

... **Reduced visible smoke** plumes from fuel-oil burning industries.

... **Cut the average** and maximum levels of sulfur dioxide in the air.

Griswold said these results were achieved by banning the burning of an estimated 45,000 bbl. daily of fuel oil during the 5-month period.

Speaking for the oil industry, Philip K. Verleger, special counsel for the Western Oil and Gas Association, made these counter-claims:

... **A day-to-day study** of the amounts of fuel oil burned, as compared with eye irritation and visibility, established there is no correlation between the two.

... **Plant pathologists** agree sulfur is not a problem in crop damage in the Los Angeles basin.

... **Even without Rule 62,** with very rare exceptions, the sulfur dioxides in the basin's atmosphere have always been far below the recent tentative standards announced by the California Department of Public Health.

In addition, Verleger charged that Griswold's summary of the "supposed benefits" of Rule 62 didn't tell the whole story. Specifically, he said, it didn't include its failures.

In answer to inquiries as to what would be involved in extending the fuel-oil burning ban to a year-round basis, G. W. Wadsworth, Jr., president of Southern Counties Gas Co., said the cost would be prohibitive.

For instance, Wadsworth said, costs of just pipelines and related facilities necessary to supply natural gas all year to all fuel users in the county would run around $610,000,000. This figure anticipates a need for an additional 925 million cubic feet daily capacity to the Los Angeles basin.

Wadsworth said El Paso Natural Gas Co. estimates it would cost $310 million to increase its transmission facilities to the California border and the local gas companies would have to spend $300 million to take care of the added increment within its systems.

States Warned U. S. May Take Over Proration

A CAMPAIGN may be launched in 1960 to spread conservation and proration laws to all oil states so the crude market may be shared more equitably.

Request for such an education drive was made to the Interstate Oil Compact Commission at its annual meeting in Philadelphia. The plan was broached by the Oklahoma Independent Petroleum Association through its president, Paul R. Schultz of Blackwell Oil & Gas Co., Tulsa.

The IOCC executive committee will take up the proposal at its meeting in February.

Now that there is a limitation on imports, Schultz said, some states are threatening to fight others over what they consider to be their fair share of the remaining market. He warned that if this happens, proration might be taken over "by somebody bigger than any of the states."

Schultz presented statistics showing the production of various states and regions as related to their reserves and productive capacity. He pointed out that in recent months Louisiana and the Rocky Mountain region have sharply increased their share of U. S. production at the expense of declines in other places, notably Texas and Oklahoma.

The IOCC also:

... **Abolished** its special committee to study the effect of imports on oil conservation. The committee had completed its assignment.

... **Adopted** a resolution warning member states to watch a proposal pending in Congress to establish a national fuels policy, pointing out that it might affect the minerals policies of the states.

... **Authorized** its legal committee to make studies on the need for uniform state statutes on ratable take and common-purchaser regulation, right of eminent domain for acquiring areas for underground storage of natural gas, and on proper well spacing.

... **Heard** several speeches and reports on the early history and achievements of the compact in its 25 years of existence.

... **Elected** Gov. George Docking of Kansas as chairman for 1960; Warwick M. Downing, chairman of the Colorado Oil and Gas Commission, as first vice chairman; and Genevieve Blatt, Pennsylvania's secretary of internal affairs, as second vice chairman. Lawrence R. Alley, Oklahoma City, was reelected executive secretary.

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The Journal Index

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Esso Workers Crush Teamsters Union Bid

• Baton Rouge refinery employes stick with independent union in lopsided vote, striking a hard ballot-box blow at Jimmy Hoffa's expansion plans.

IN SHARP contrast to another refinery election in the Jersey Standard family, employes of the Esso Standard Oil Co. refinery at Baton Rouge have decided to stick with their independent union.

The lopsided vote in the bargaining-agent election was notable for several reasons:

... **It crushed** the bid of Jimmy Hoffa and his Teamsters Union to organize the nation's refineries.

... **It reversed** the recent success story of the Oil, Chemical and Atomic Workers Union, which won an election from an independent union of Humble Oil & Refining Co. in Baytown, Tex., last August.

... **It reaffirmed** the strength of at least one independent union and indicated satisfaction with the union's earlier contract negotiations.

The election at Baton Rouge also was remarkable because of the tremendous majority rolled up by the Independent Industrial Workers Union, which captured 2,561 votes, or about 75% of the total.

The Teamsters ran a poor second with 498 votes, and the OCAW got only 124. The Baton Rouge Metal Trades Council received 50 votes. Forty-two workers voted against any union representation at all.

The IIWA victory occurred in the face of personal visits to Baton Rouge by both Hoffa of the Teamsters and O. A. Knight, the OCAW chief.

Prior to circulation of the petition for the election, IIWA officials had negotiated and approved a new contract with management, but the membership did not get a chance to vote on it. Because of the earlier negotiating success, it was believed likely that another contract along similar lines will be drafted.

UNIQUE union tactic is a sign outside OCAW Local 449 headquarters at Texas City bearing names of men who have returned to work at the strike-bound Amoco refinery.

Strike front . . . Meanwhile, the long strike of American Oil Co. refinery workers at Texas City, Tex., continued, although a trickle of men were returning to work.

The company said that, in some respects, management and labor are further apart today than they were when the strike began on July 1. Plant Manager B. F. Babin said the OCAW negotiators "continue to press for contract changes designed to limit management's responsibility to operate the plant in a safe and reasonable manner."

Babin said the union also has demanded, as a condition of settlement, that the company reinstate three employes discharged or suspended "for flagrant misconduct during the strike."

The union has filed new charges against the company with the NLRB, although earlier charges of unfair practices were dismissed.

Canada Seeks Sulfur-LPG Line

FOOTHILLS Products Pipe Line, Ltd., of Calgary is conducting a survey to determine the feasibility of a products pipeline from the Calgary area to Milwaukee.

The line would cost about $190,000,000 and would carry sulfur, propane, and butane to U. S. markets.

The company is now asking various state-government bodies in the U. S. to determine what authority would have to be obtained.

Company officials also reported considerable money is being spent to determine the engineering feasibility of the line and to explore market possibilities.

One of the major questions is whether to construct two separate lines or one. An attempt is being made to determine if sulfur could be carried in a slurry, with the liquid petroleum gases carrying the sulfur. This would require only one line.

If this is not feasible, the liquid gases would be carried in one pipeline, and the sulfur, in the form of hydrogen sulfide, in the other.

Once large-scale export of Alberta natural gas is approved, Alberta will be a major producer of sulfur and liquid petroleum gases. These products must be removed from much of the gas in this province before it is suitable for pipeline delivery.

Foothills would own and operate the pipeline. Foothills was formed by Mannix Co., Ltd., Pembina Pipe Line, Ltd., and a number of businessmen.

The group also has under consideration an $80,000,000 products line to the Pacific region.

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Process Converts Sea Water

. . . to fresh by nuclear method for 42 cents per 1,000 gallons. Fluor plans government test plant at San Diego.

A RECORD low-cost method for conversion of sea water to fresh water has been revealed in Los Angeles.

The Fluor Corp., Ltd., reported to the Interior Department it could produce fresh water from saline water at a cost of 42 cents per thousand gallons in a 50 million gallon per day plant. This compares with previous low estimates of 50 to 60 cents per thousand gallons.

Smaller conversion plants in Aruba and Saudi Arabia now turn out fresh water at a cost in excess of $1 per thousand gallons.

In its $100,000 study for the Interior Department, Fluor cited these statistics:

. . . **The 42 cents** per thousand gallons cost is based on amortizing a $42.2 million plant over a 23½ year plant life span and includes all operating costs for that period.

. . . **Conversion steam** would be supplied by a 370-thermal-megawatt pressurized nuclear steam generator.

Plant planned—Fluor currently is designing and engineering a small nuclear salt water conversion plant to be located near Pt. Loma in San Diego. It will be built for the Interior Department's Office of Saline Water as one of five demonstrator plants authorized by Congress last year.

Construction on the $2 million multi-flash distillation plant is slated to begin early in 1961. It will vaporize sea water with nuclear heat and recover 1 million gallons of fresh water daily. The city has signed up to buy the water at 20 cents per thousand gallons.

Developments in the field of nuclear sea water conversion are being closely watched by a number of areas outside the United States, including Libya, Argentina and portions of Patagonia where fresh water is scarce.

Economic conversion of sea water would be of tremendous benefit to semi-arid southern California, where a fast developing water shortage is expected to eventually stunt that booming area's growth.

The Los Angeles area alone uses an average of 400 million gallons of fresh water daily with peak days exceeding 700 million gallons.

This large volume of water is brought long distances from the Sierra Nevada water-shed areas at a cost of about $26 an acre foot. Sea water converted by the Fluor process would cost about $120 an acre foot.

In-situ project sought in Oklahoma

PERMIT to begin an in-situ combustion project in the Seay field of Jefferson County, Oklahoma, has been asked of the Oklahoma Corporation Commission by Thermal Oil Producers, Inc., of Abilene, Tex. Hearing is scheduled December 23.

Hydrocarbons underlying between 90 and 100 acres would be ignited in the Cisco sands at 850 ft.

There are four wells in the project. One would be used for air injection at the rate of 3 million cubic feet daily at 300 psi. Production would be from the other three wells.

The application said the sand is an anticline with some truncation and lensing and holds "substantial quantities of oil which cannot be recovered by primary methods." It added studies indicate the sand conditions suitable for successful thermal recovery operations.

The wells are in the W½ NE NW, Lots 2, 3, and 4, of 19-7s-5w, in Jefferson County, near the Oklahoma-Texas border.

PROCESSING BRIEFS . . .

Humble Oil & Refining has bought 12 service stations from Famariss Oil & Refining Co., Hobbs, N. M. The stations are in Albuquerque, Grants, and Ruidoso.

Phillips Chemical is expanding its polybutadiene-rubber capacity at Borger, Tex., to 20,000 long tons a year. An expansion under way at Borger is scheduled for completion next August.

AviSun Corp. has become the nation's first fully integrated polypropylene-film producer. Commercial production of OLEFANE, the company's polypropylene film, has begun at New Castle, Del. The new Delaware plan has an annual capacity of 10 million pounds. AviSun recently completed a 20-million-pound polypropylene polymer plant at Port Reading, N. J., and plans to enter the polypropylene-fiber market next year.

A $1,500,000 contract has been awarded by Regent Refining for construction of a 4,700-bbl. catalytic reforming unit for its Port Credit refinery near Toronto. The unit will replace an existing 2,000-bbl. unit. It will be built by Catalytic Construction of Canada, Ltd. and is scheduled for completion by September, 1960.

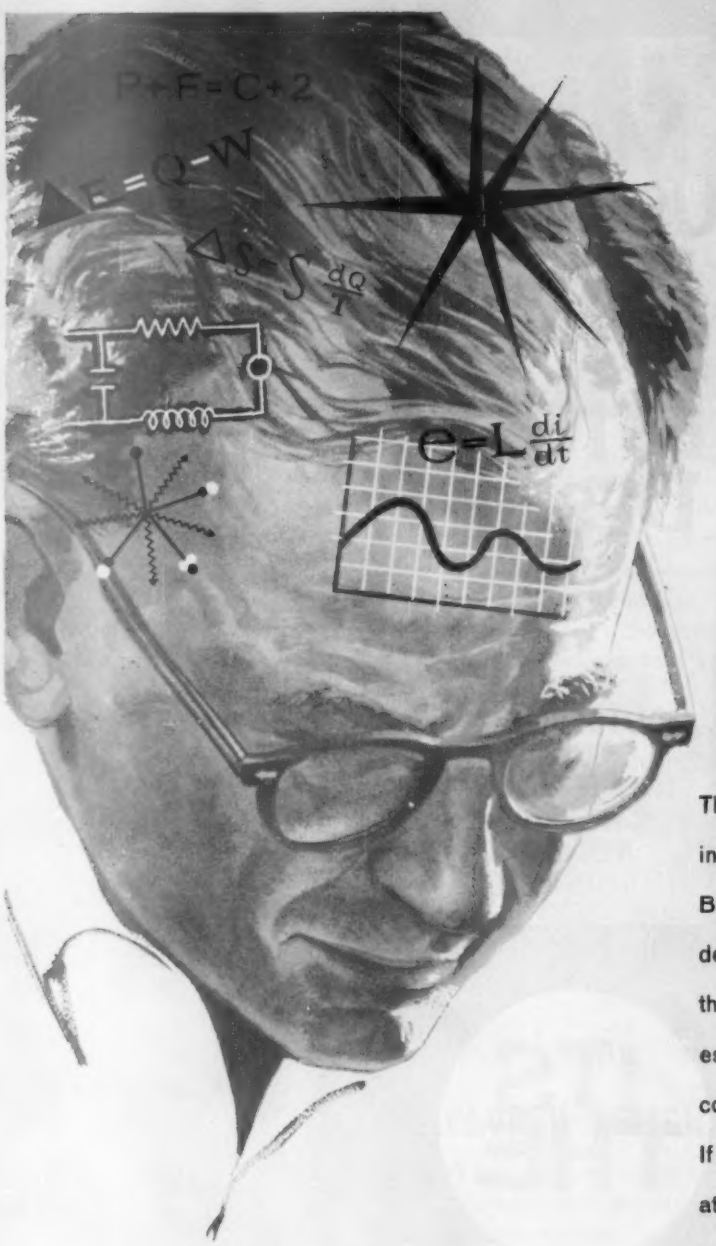
Whale Oil Co., Inc., independent fuel-oil supplier, plans a multimillion dollar expansion and redevelopment program along the Brooklyn waterfront. The expansion includes storage facilities above and below ground for more than 200 million gallons of fuel oil which can provide uninterrupted service for 100,000 homes during a year-long period.

A 7,000-bbl. delayed coking unit at Suntide Refining Co.'s Corpus Christi, Tex., plant will be completed by the end of December 1959. The unit is being built by Refinery Engineering.

Also for Refiners . . .

IN THE NEWS: Coal men are exerting new political and economic pressure in a deliberate drive to undermine Oil's markets (p. 41) . . . Signal starts custom blending in California after successful tests in Nevada (p. 43) . . . Experience of last few years is making catalytic cracking a much more flexible tool (p. 46) . . . Pollution officials, oil men dispute results of Los Angeles' fuel-oil ban (p. 53) . . . Baton Rouge Esso workers vote for an independent union (p. 54) . . .

PLUS THESE TECHNICAL REPORTS: How to select refinery and petrochemical drives (p. 76) . . . CO boiler pays off for Utah Oil (p. 80).



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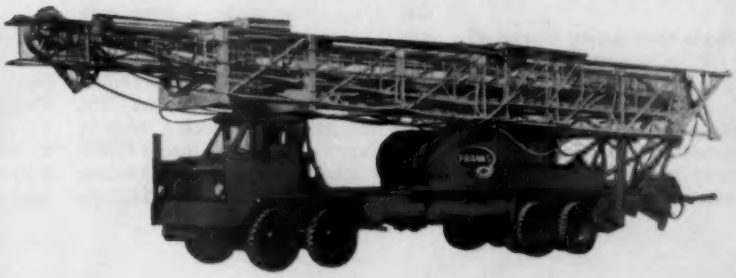


Alberta Water Holds Mineral Bonus

• Oil-gas board studies extraction of iodine, bromine, and magnesium. Royalties could pose a problem.

OIL COMPANIES may soon be able to use everything arising from production of oil and natural gas but the proverbial "pig's squeal."

Already gas, incidental to the production of oil, is being treated and commercially marketed along with its byproducts. Liquid petroleum gases and sulfur, incidental to the production of natural gas, also are being treated and marketed.

Now, the next step may be the utilization of underground water brought to the surface with oil and gas.

A publication of the Alberta Bureau of Statistics, "Alberta Industry and Resources," states:

"Formation waters of some oil fields in Alberta carry high concentrations of soluble materials. For example, waters from the Wizard Lake field contain about 17,000 milligrams per litre of magnesium, 1,400 of bromine, 18 of iodine, 20,000 of calcium, 46,000 of sodium, 195,000 of chloride, and less than 200 each of bicarbonate and sulphate.

"The analyses, together with information on quantity and availability of water produced, are presently being studied by the Research Council, with the intention of reviewing the possibilities of commercial extraction of certain elements."

Magnesium extracted . . . In some spots of the Wizard Lake field, southwest of Edmonton, magnesium concentration runs as high as 5.95 lb. per barrel, or over 12 times that of sea water.

For several years now, Dow Chemical Co. has been using sea water and water from underground formations in the U. S. for commercial production of some of these solubles.

The Alberta Government publication states that the amount of magnesium theoretically recoverable from the Redwater field may be as high as 462,000 lb. per month.

The uses for some of these products:

. . . Magnesium, used in high-strength, lightweight structural alloys; the production of titanium; a cathodic protecting agent for iron and steel equipment, such as pipelines; and in the cement, fertilizer, chemical, and textile industries.

. . . Bromine, used as an antiknock compound in the production of gasolines; in medicine and photography; and recently as a fumigation agent.

. . . Iodine, used for a vast number of purposes, including medicine, photography, foodstuffs, metallurgy, and dyes.

A spokesman for the oil industry said in Calgary that if it should be found practical to "mine" some of these products, it would likely be done by taking the water from the wellhead, removing the solubles at a central field plant, and re-injecting the water into the well.

Although the project is in preliminary stages, it is generally believed that certain changes would likely have to be made in the terms of Crown leases. Although it should be automatic for these products to be included in mineral rights, such matters as royalties and conservation may have to be included in the terms.

For this reason, there would have to be close cooperation between the Alberta Government and the Alberta Oil and Gas Conservation Board.

The board's interest would be in making sure the removal of the water would not reduce the pressure necessary for the recovery of oil and gas. Another problem is who has first call on the mineral-bearing waters.

INDUSTRY BRIEFS . . .

Trial of the Government's price-fixing conspiracy case against 29 major oil companies is now set for February 1 in U. S. District Court, Tulsa. A 2-week postponement from the original January 18 date was ordered by U. S. District Judge Royce H. Savage, after Joseph E. McDowell, who will head the Government's prosecution, said the Government could not file its pre-trial briefs before January 15.

The Alberta Oil and Gas Conservation Board has set Alberta's oil allowable for December at 384,781 bbl. per day, about 46% of the producing potential. This is an increase of 62,280 bbl. per day over November.

Natural-gas sales during August advanced 11.8% above the August 1958 level, the American Gas Association reports. Although the nation-wide steel strike was in its second month, high demands by industrial customers were largely responsible for the increase. Gas sales for the year ending August 31 were up 9.1% from the previous 12-month period.

Oklahoma allowable for December and January was set at 545,000 bbl. daily, unchanged from October and November, by the Oklahoma Corporation Commission. The state's basic minimum per well rate will remain at 20 bbl.

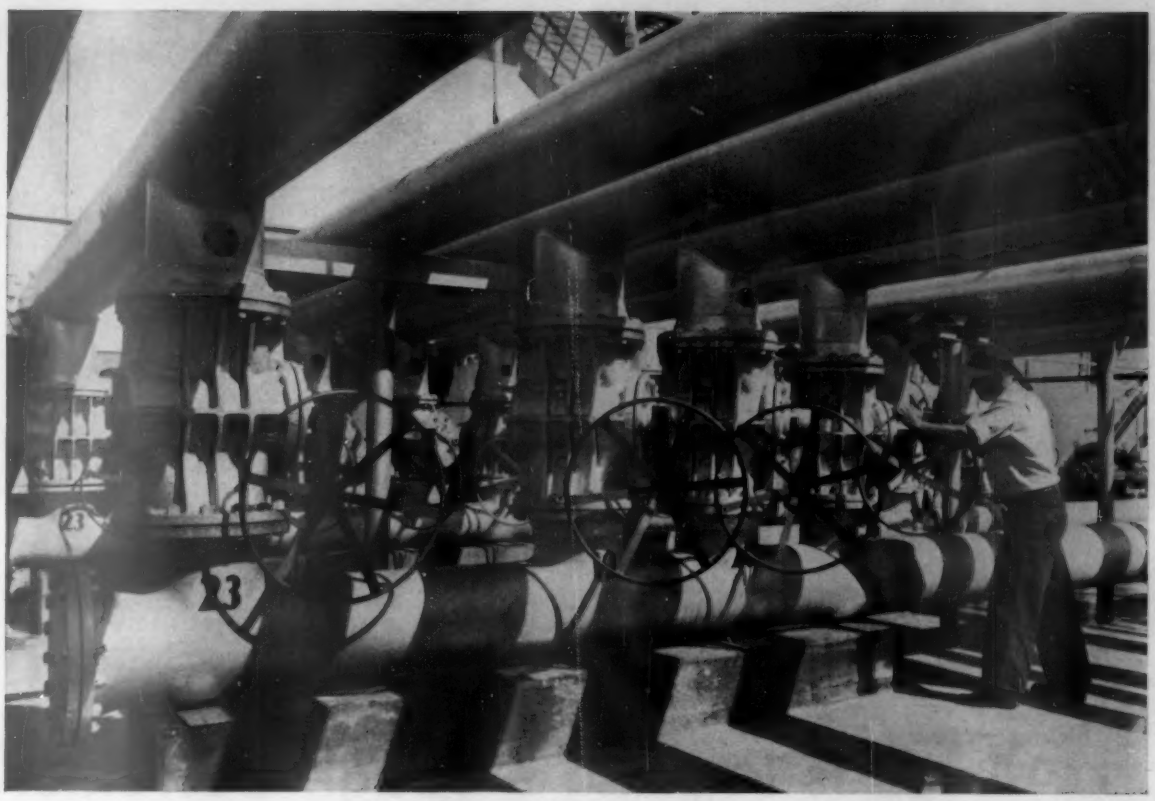
The California Supreme Court has postponed until February any action on Richfield Oil Corp.'s suit to kill a California Public Utilities Commission order shutting down Richfield's 58-mile gas line from San Joaquin valley to the California coast. The line is operating under a temporary stay.

Republic Natural Gas Co., Dallas, and Harper Oil Co., Oklahoma City, have acquired 17 producing wells in East Happy Hills field, Lincoln County, Oklahoma, from Lincoln Drilling Co. and others. Price was $1,250,000. Secondary recovery is planned on the leases, which total 1,000 acres recently developed on 40-acre spacing.

State tax collections on North Dakota oil and gas totaled $633,562 for 3 months ending September 30, highest for any quarter since oil was discovered in Williams County in 1951. Value of production in 10 counties was $12,671,276 for the 3 months. The state tax is 5% of wellhead value.

The Texas Railroad Commission wants major crude purchasers to take another look at their crude and products inventories. The commission has asked the companies to furnish figures on their stocks as of December 1 in barrels, not days' supply.

Continental Oil Co. has purchased 109 producing wells in the old Loco field, Stephens County, Oklahoma. The properties have reserves of about 10 million barrels of oil recoverable by secondary methods. A water-flood project is expected to be started in the near future.



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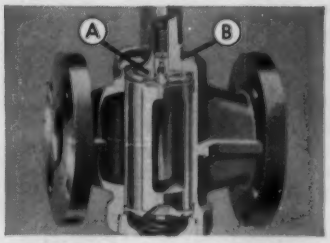

Cross-section of Homestead Lubricated Plug Valve. Triple head seal (A) prevents leakage. Tell-tale lubricant ring at (B) signals full system, prevents waste of lubricant and contamination of line fluids.

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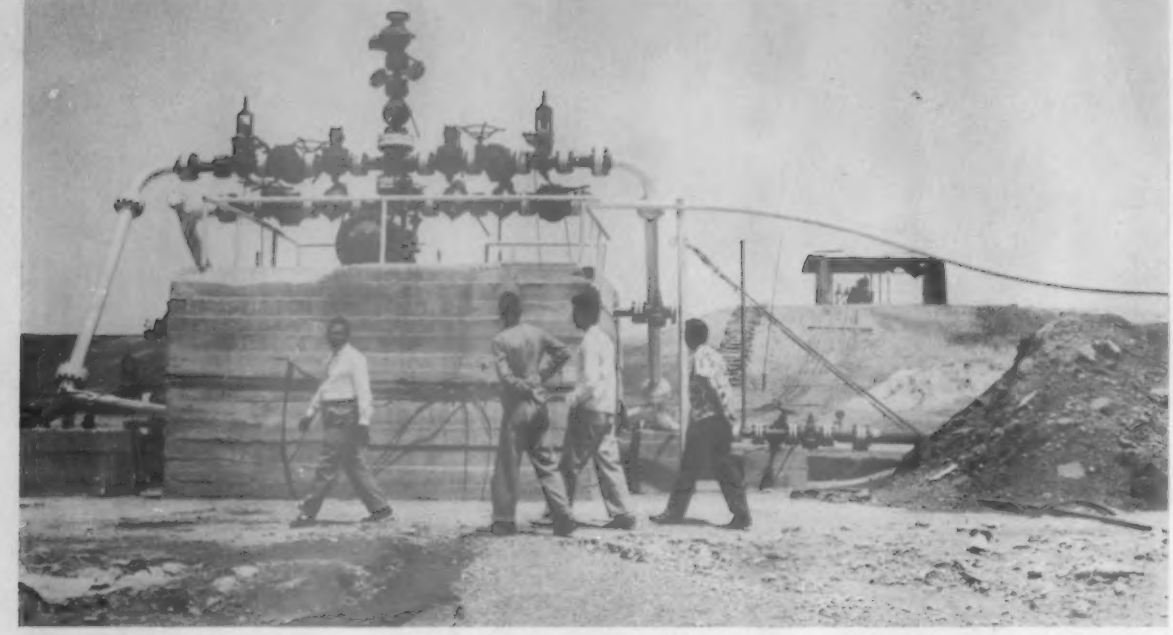


AN ELABORATE maze of valves and two 4-in. bleedoff lines show the respect Iran Oil Co. has for Alborz 5, which blew wild for almost 3 months before bridging itself.

Alborz Is Proving a Tough Customer

• This big structure in central Iran proved it packs a big wallop when the Alborz 5 blew wild for weeks. One stepout has found the same high pressures, but only more drilling will determine just how prolific the structure is.

Paul Swain
International Editor

THE IRANIANS may or may not have a tiger by the tail at Alborz, but just in case they're treating the big structure 70 miles south-southwest of Teheran with all the respect due a big Bengal cat.

Alborz 5 furnished modern drilling history with one of its most spectacular blowouts more than 3 years ago. It proved to Iran's satisfaction that the Central Iranian basin is productive. It also taught the Iranians caution.

So far, Iran Oil Co., the exploration subsidiary of the government-owned National Iranian Oil Co., has not made Alborz pay off in spite of the wild well that produced more than 5 million barrels of oil before it tamed itself. But, the national company is still doggedly probing the big structure trying to learn its secrets. The big blowout made caution the byword.

"Frankly, we're afraid of it," S. T. Turabi, Oklahoma University-educated technical director of I.O.C., says as he looks at the idle derrick sitting over Alborz 5A, drilled just 1,600 ft. from the blowout.

The 5A encountered high pressures at just less than 7,800 ft. and the prudent Iranians decided to shut down the operation until they gain more experience with the substructure.

"We hope to gain enough experience with the other tests we're drilling and then come back to this one," Turabi explains.

The wells 6 and 7 were not successful in bringing in the production that I.O.C. is certain exists at Alborz. The Iranians are now banking on No. 8 to do the job.

The latest in a series of teasing tests of the big Alborz structure is 1½ miles southeast of No. 5 and to the south of the major thrust to the north that previous wells revealed.

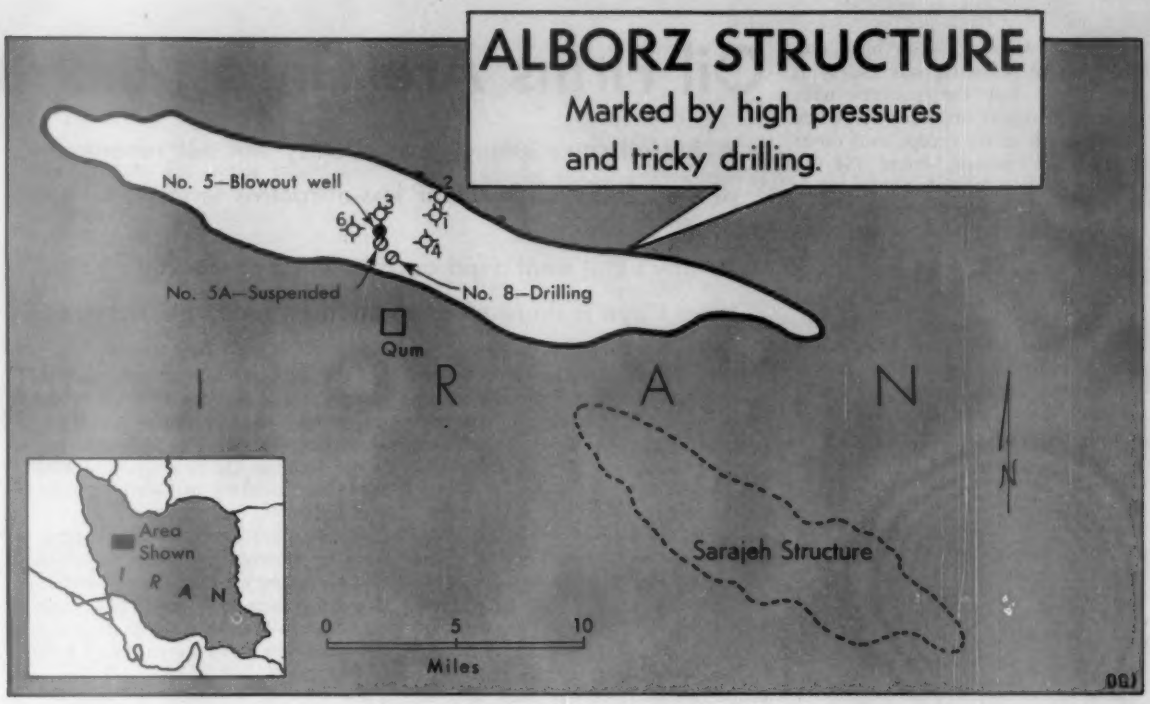
It is a typical Alborz well with all the mechanical problems that the Iranian drilling crews have encountered in the past. Last week crews were fishing for stuck pipe in the hole at 9,923 ft. This is an old story at Alborz, but this test has at least carried its hole 1,500 ft. deeper looking for the Oligo-Miocene limestone that is the goal.

At its present depth, Alborz 8 is about 1,400 ft. below the level where Alborz 5 found the Qum limestone with such pyrotechnic results.

The past history . . . The Iranians first began looking for oil on their own in 1950 after photogeology and field surveys revealed two large structures in the Central Iranian basin near the village of Qum.

The larger of the two, trending southeast-northwest, lies in sight of Qum and to the north of the village. It is 30 miles long and more than 7 miles wide. The Iranians labeled it Alborz and made plans to test it with a bit.

Between 1951 and 1956 five tests were drilled on the structure, the shallowest to 2,060 ft. and the deepest to 8,460 ft. Except for the shal-



for Iranians

low structure test, misfortune plagued them all. None reached the limestone target. Each had to be abandoned because of mechanical troubles in the hole.

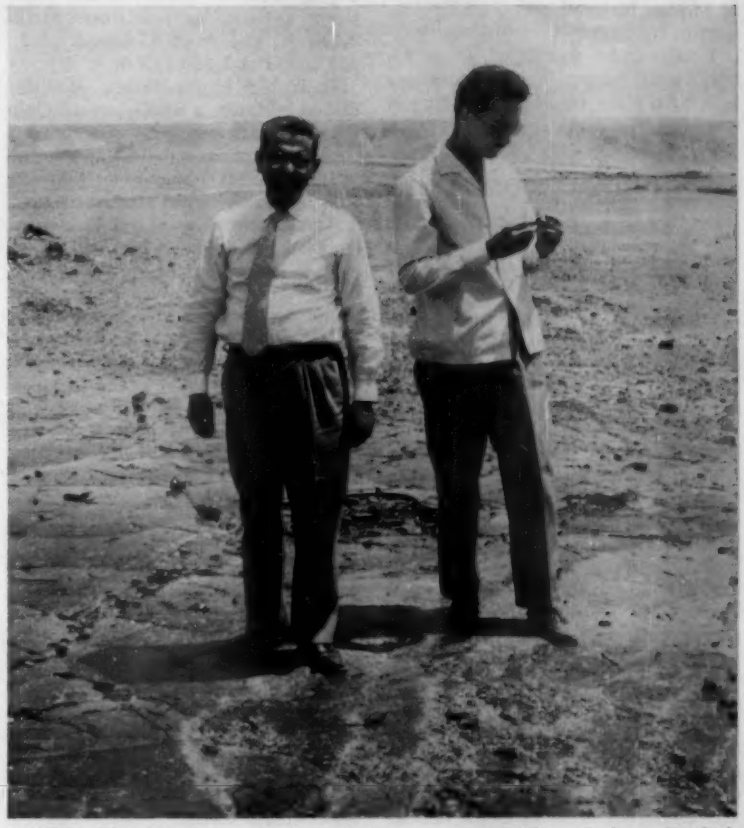
The Alborz villain has always been —and still is—the salt, anhydrite, and highly plastic red saline marls which overlie the limestone target. Every well drilled so far has had stuck pipe problems, twistoffs, and countless fishing jobs.

Alborz 5 is the only test yet drilled to reach the limestone. I.O.C. geologists say it is similar to the prolific Asmari which produces in all the southwestern fields of Iran, the nearest of them 200 miles away.

Early in the morning of August 26, 1956, Alborz 5 was drilling in a section of rock salt and believed to be at last about to encounter its target. The drilling mud was a supersaturated, salt-base, heavy mud weighing 135 lb. per cubic foot. Because of high pressures encountered in previous wells, engineers were afraid if they encountered fractured limestones below the salt section, the heavy drilling fluid would cause lost circulation.

They reduced the mud weight to 129 lb. per cubic foot and drilled ahead until they encountered the hard rock. I.O.C. meant to drill only a foot into the limestone and then core.

The bit ground only 2 in. into the



A SHEET of black glass covers much of the area around Alborz 5, the well which blew wild. The extreme heat from the blowout melted much of the sand around the well, creating the glass. Examining a section of the glass is F. Forootan, right, assistant field superintendent at Alborz. At his left is T. Turabi, IOC's technical director.

hard rock when the well blew out. The blowout preventer was useless. It was closed but the packers were blown out almost immediately. There wasn't much to do except shut down the engines, pumps, douse the rig lights and wait until dawn.

The rest is history. The well blew wild from that day until November 18 when it bridged itself and stopped flowing. Before that happened it had produced an estimated 5 million barrels of oil which I.O.C. hastily collected in huge lakes by building dams over the surrounding country side.

No one ever succeeded in shutting the well in entirely until she did it herself. During a prolonged period of "control," it flowed through a 4-in. line at a wellhead pressure of 1,800 psi. Because of the danger of fire, this flow was finally ignited 3 weeks after the blowout occurred.

Today, special flow lines to the wellhead—one to the east and another to the west—are still open. The well still kicks occasionally.

When shut in, Alborz 5 still builds up 4,000 to 5,000 psi. wellhead pressure and has to be bled off in spite of Mother Nature's bridge which does control it.

Little wonder that I.O.C. treats Alborz with respect as the company tries to tap the reservoir it is sure is there.

Maracaibo Test Hits

. . . for Indiana Standard. Well good for 6,000 bbl. daily from two zones.

A DISCOVERY in Lake Maracaibo may give Indiana Standard its first worthwhile production in Venezuela.

The well is the SLG-12-3X on Block 12 in the central part of the lake. It flowed a reported 6,000 bbl. daily from sands in two zones believed to be of the "B" group Eocene.

A 90-ft. section of upper sands from 9,870-9,960 ft. flowed 37°-gravity crude. A 70-ft. section of lower sands from 9,980-10,150-ft. yielded 32°-gravity oil. Each interval tested about 3,000 bbl. daily.

The find is undoubtedly of particular importance to Pan Venezuelan Oil, Indiana Standard's subsidiary in Venezuela, which has one-third interest in the block. The company has been an orphan among the firms which 3 years ago invested a total of $667 million for new concessions, many of which have since yielded major discoveries.

Partners with Pan Am in Block 12 are Venezuelan Atlantic, 33⅓%; Sun Oil, 23⅓%; and Texaco, 10%.

Oil Firms Are Giving Libya

- But oil commissioner says country will not renege on earlier deals made under less-attractive terms to Libya.
- Italy's ENI went overboard to win a concession. Mattei gave Libya a share of company in order to get acreage.

LIBYA added two more producers to its growing roster last week about the same time it became apparent that open acreage left in the North African country is regarded by the oil world as a golden apple.

The newest find is a 3-mile stepout at Oasis Oil's Dahra field in the north central part of the country. At about the same time, Esso Standard said that the new deeper pay at its Zelten 3 well is good for 1,600 bbl. daily of water-free oil.

The new Oasis well, F-2-32, flowed at the rate of 2,800-bbl. daily through casing. The 43°-gravity crude came from a 64-ft. section from 3,086-3,150 ft. and from a second 20 ft. pay found at 3,160-180 ft.

It is the fourth Dahra producer drilled by Oasis, a wholly owned Ohio Oil subsidiary acting as operator for the Ohio-Continental-Amerada group on the 1,250,000-acre concession just 75 miles south of the Mediterranean.

The 1,600-bbl. daily figure revealed by Esso for Zelten 3 ranks the third well in the new field at considerably below the first two, but opens up a whole new producing horizon in the Cretaceous underlying the Paleocene which produced at the rate of 17,500 and 15,000 bbl. daily in the first two Zelten wells (OGJ, Nov. 30, p. 56).

The two new finds came on the heels of mounting evidence that Libya's almost phenomenal success ratio has made her the top prize of the world's oil hunters.

Anis Qasem, member of Libya's petroleum commission who headed the government oil agency when the country was opened in 1955, told the Journal his country is getting a better break each time a new concession is granted.

Qasem, a knowledgeable London-educated lawyer, emphasizes that this is happening without Libya's departing from the established terms of its oil law. Qasem surprised and pleased Western oil company observers last April in Cairo when he almost became the champion of existing oil contracts in the face of growing Arab complaints about terms once granted but which they now want changed.

"The Libyan Government has frequently made it clear that its policy is based on honoring conditions already agreed to. This was the position I took at the recently held first Arab Oil Congress in Cairo," Qasem said last week.

Slightly built and mustached, pipe-smoking Qasem is obviously pleased that his country has become so attractive it can now get a better deal from oil companies and still keep the word it once gaven when Libya didn't look so promising.

He cites the following as examples:

. . . **Drilling** programs are now being submitted by concession holders.

. . . **The 25% depletion** provision of the law is almost universally being surrendered by companies eager to acquire acreage in Libya.

. . . **Government** participation is being offered Libya in return for concession grants.

ENI's deal . . . The latest and most startling "good deal" offered Libya came from Enrico Mattei, volatile head of Italy's government-owned Ente Nazionale Idrocarburi. As he has done previously in Iran and Morocco, Mattei gave Libya a piece of his company in order to get into Libyan exploration.

"This development was the grant of a concession to Cia. Richerche Idrocarburi (CORI), an affiliate of AGIP Mineraria, the Italian Government company," Qasem explained.

"The agreement with this company provides for government participation in the operations of the company to the extent of 30% after discovery of oil in commercial quantities.

"This participation includes search for oil, development, exploitation, transportation in Libya, and marketing. The door is left open for participation no less than 30% in other petroleum operations.

"The royalty was increased from 12½% to 17% and the percentage depletion was surrendered.

"The 50-50 division of profits was preserved."

The CORI concession covers about 11,500 sq. miles in eastern Libya in

Better Deals

the province of Cyrenaica. The acreage is about 200 miles inland from the Mediterranean coast.

Just last week an official of American Overseas, exploration company from the Caltex group, commented ruefully:

"I wish he'd got that Fezzan block. We drilled a dry hole on it."

Drilling programs . . . Another advantage which Qasem cites as a direct result of Libya's oil discoveries is the fact that all companies are now submitting drilling programs to the commission.

"The encouraging results led to keener competition in both drilling and applying for areas that are still free. Concentration of efforts immediately jumped to the Zelten and Gulf of Sirte areas.

"Areas which were free for 4 years suddenly became the object of great conflict unprecedented except for the first round of granting concessions in 1955.

"This opportunity was not missed by the Libyan petroleum commission to improve the terms of the grants. Drilling obligations became a rule for every new concession.

"The petroleum law does not deal directly with this subject. There is the obligation of the concession holder to follow good oil-field practice and to diligently prosecute all his operations under the concession in a workman-like manner and by appropriate scientific methods."

Qasem now says in order to avoid any arguments or questions of interpretation of the oil law, the commission has started requesting applicants to submit a program of operations with a definite drilling commitment.

Libya's Anis Qasem
. . . what a difference 4 years has made to his country.

Depletions . . . The principle of percentage depletion which was written into Libya's oil law has been taking a real beating as companies jockey for new acreage.

"It has now become almost the accepted standard with the applicant to surrender his claim to percentage depletion in the form provided in the law. Concessions have been granted with this surrender agreed," Qasem says.

"An even further development in this line was September 5 when British Petroleum offered to surrender the depletion provision not only with respect to newly applied for areas, but also with respect to oil concessions granted to the company some time ago."

It's pretty obvious that Qasem relishes the new Libyan standing in the oil world a great deal.

Kassim Lays Down Tough Policy for IPC

IRAQ is stepping up its demands on Iraq Petroleum and affiliated companies for the surrender of concession acreage.

Premier Abdul Karim Kassim says his government not only is telling Iraq Petroleum it must give up 60% of its acreage, but that the government will select the areas to be surrendered. He announced his plans as one of his first acts on leaving a Baghdad hospital after 2 months of recuperation from a gun-shot wound inflicted in an assassination attempt.

IPC and its affiliates, Basrah Petroleum and Mosul Petroleum, have concessions over all except a small corner of the country. The rights cover about 172,000 sq. miles. Basrah Petroleum has already given up exploration rights on Iraq's territorial waters in the Persian Gulf.

Premier Kassim said the Iraq Petroleum group has already offered to reduce its concessions by 90,000 sq. km., or about 35,000 sq. miles. He made clear, however, that his government is going to continue to negotiate for more.

IPC and its affiliates are owned by British Petroleum, Royal Dutch-Shell, and Cie. Francaise des Petroles, each with 23¾%; Jersey Standard and Socony Mobil, which jointly hold another 23¾%; and the Gulbenkian estate, 5%.

The group has invested heavily in oil facilities in the country since a revolution last year brought the Kassim government into power. Oil operations since then have run smoothly, and crude production late this year reached a record high of more than 900,000 bbl. daily.

A looping program in the IPC pipeline system from Kirkuk to the Mediterranean will increase capacity of the big field to 700,000 bbl. daily by the end of 1960. A deepwater terminal being set up in the Persian Gulf off Fao will permit production of 440,000 bbl. daily from Iraq's southern fields. IPC's two big fields in southern Iraq are Zubair and Rumaila.

Hassi Messaoud Line To Give France New Life

THE FRENCH have never quite recovered from their fright when Nasser and the Arab world cut off Middle East oil supplies to Europe in 1956.

Last week they joyfully poured a little petroleum balm on those old wounds with full-fledged ceremonies to mark the first sizeable flow of French Saharan oil to French markets.

There was the traditional ribbon cutting, but in reality it marked the first real snip in the ribbon that has tied France to the Middle East.

The event was the formal opening of the 24-in., $100-million pipeline that snakes its way north the 412 miles separating the big Hassi Messaoud field and a new deepwater port at Bougie.

Lending emphasis to the importance of the big event, French Premier Michel Debre led a group of 300 French dignitaries through a 3-day series of ceremonies from the Sahara to the Mediterranean to France.

At Haoud el Hamra, just north of Hassi Messaoud, Premier Debre turned a symbolic valve to start 90,000 bbl. daily of high-gravity crude north to Bougie. Actually, Hassi Messaoud crude has been moving through the line for weeks in testing and storage-fill operations.

Then the French premier boarded his Caravelle jet and flew north for an overnight stay at Bone (rather than Algiers where nationalist elements were expected to demonstrate in protest). The following day he flew to Bougie where he cut a tricolor ribbon on another valve and watched the loading of a 48,000-ton tanker.

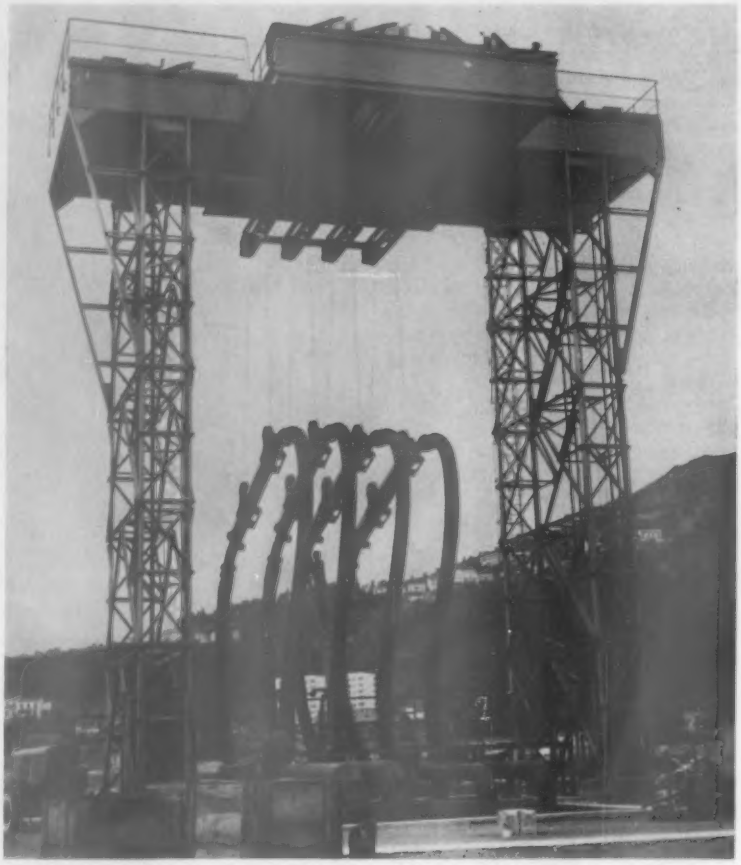
The third day, the official French party took part in further ceremonies at the 104,000-bbl. daily Lavera refinery operated by the French affiliate of British Petroleum near Marseilles. The short tanker haul from Bougie to the southern French coast made the 3-day sequence possible.

Operation of the new pipeline will boost Hassi Messaoud production for 1959 to an average of about 30,000 bbl. daily from 20 of the field's 48 wells that have now been completed. The first half of this year more than 18,000 bbl. daily was moved north through a small pipeline and railroad.

Future plans . . . By next year the French expect this daily average to reach 200,000 bbl. and they are shooting at 1,000,000 bbl. daily from the Sahara by 1965.

With only two stations in operation, the pipeline will move between 90,000 and 100,000 bbl. daily. A third station already under construction will boost this another 90,000 bbl. daily, and a fourth to help push the crude over a 3,400-ft. Hodna Mountain Pass will hike the throughput to 280,000 bbl.

The one knotty and still very big problem which must be solved is finding a home for all this oil in an already flooded world market place. The Saharan crude is very light with a gasoline cut of more than 40%. Only 29% of the French domestic market is for gasoline. The biggest use is fuel oil—49%.



A GIANT ARCHWAY at the Mediterranean seaport of Bougie, Algeria, marks the end of the crude line from big Hassi Messaoud field. The arch handles lines which discharge water used to ballast tankers coming to Bougie to pick up Hassi Messaoud crude.

Spain Grants Acreage Under New Law

FOUR GROUPS of companies have won the first concessions to be awarded in Spain since the passage of a new oil law earlier this year.

A Gulf Oil subsidiary that had submitted applications jointly with Diehlmann, of West Germany, obtained 10 blocks covering 104,000 acres in Barcelona and Lerida provinces. Gulf had earlier received a concession in Spanish Guinea in a joint bid with Cepsa, a local Spanish firm.

Cia. Petrolifera Iberia, in which Sun Oil Co. and Union Oil of California have two-thirds interest, acquired 11 blocks in Vizcaya, Alava, Guipuzcoa, and Navarra. The rights cover about 156,000 acres. A Jersey Standard affiliate received 10 blocks in Barcelona and Lerida covering 130,000 acres.

The government company, Campsa, was awarded seven blocks on applications in which Caltex had an interest. The rights cover about 88,000 acres in Santander and Burgos.

Citric Acid -- Dowell's New Service for Cleaning Stainless Steel Process Equipment

Now, for the first time, plant operators can be sure of a new degree of safety in the cleaning of their pressure units containing austenitic stainless steel—for example, heat exchangers, stainless-clad pressure vessels, atomic reactors, and supercritical-pressure steam generators. Citric Acid service by Dowell provides a new, effective method for these special chemical cleaning situations.

The Citric Acid used in Dowell chemical cleaning is inhibited with an *exclusive chloride-free* inhibitor. Cleaning with this new field-proven solution assures a chloride-free solvent system, and thus helps prevent chloride stress-corrosion cracking.

Dowell Citric Acid also provides other significant advantages: Citric Acid stabilizes dissolved iron and helps prevent precipitation of insoluble iron compounds when neutralizing chemicals are used. Flushing of the unit is not as difficult when Citric Acid is used. Citric Acid is especially suitable where stainless steel and other metals are used together in construction of the unit.

Citric Acid cleaning with a chloride-free inhibitor is just one of the new ideas from Dowell research. Other recent contributions include the new "white glove" standards of cleanness, copper removal agents and the new jetting device for cleaning heat exchanger tube bundles.

Ask your Dowell representative about Citric Acid service and Dowell chemical cleaning programs for your plant equipment. Dowell, the leader in chemical cleaning service and research, operates in every major industrial area through 165 offices and stations. Dowell, Tulsa 1, Oklahoma.

Chemical cleaning service for all industry DOWELL

DIVISION OF THE DOW CHEMICAL COMPANY

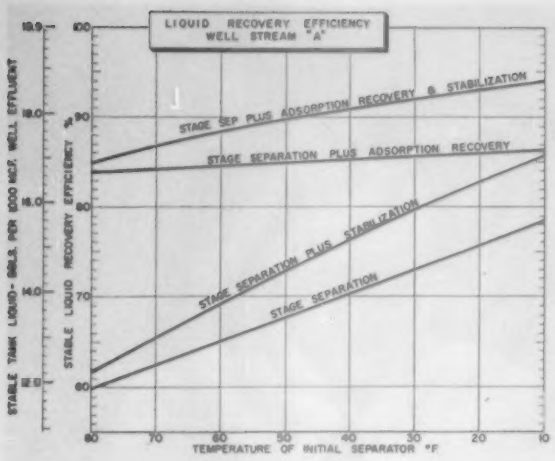

LIQUID RECOVERY EFFICIENCY
WELL STREAM "A"
STAGE SEP PLUS ADSORPTION RECOVERY & STABILIZATION
STAGE SEPARATION PLUS ADSORPTION RECOVERY
STAGE SEPARATION PLUS STABILIZATION
STAGE SEPARATION
STABLE TANK LIQUID - BBLS. PER 1000 MCF. WELL EFFLUENT
STABLE LIQUID RECOVERY EFFICIENCY %
TEMPERATURE OF INITIAL SEPARATOR °F

Fig. 1

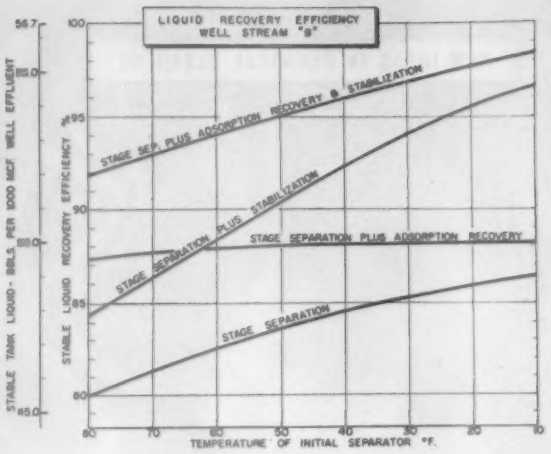

LIQUID RECOVERY EFFICIENCY
WELL STREAM "B"
STAGE SEP. PLUS ADSORPTION RECOVERY & STABILIZATION
STAGE SEPARATION PLUS STABILIZATION
STAGE SEPARATION PLUS ADSORPTION RECOVERY
STAGE SEPARATION
STABLE TANK LIQUID - BBLS. PER 1000 MCF WELL EFFLUENT
STABLE LIQUID RECOVERY EFFICIENCY %
TEMPERATURE OF INITIAL SEPARATOR °F.

Fig. 2

First, analyze; then decide—

How to increase liquid recovery

Increasing importance of gas and gas-condensate recoveries demands that high-efficiency recovery methods, screened for economic justification, be used on wet gas streams. This article establishes the magnitude of the efficiencies obtainable with today's methods and gives practical economic consideration to each of these methods.

BY A. W. FRANCIS AND
JUDSON D. LOWD
National Tank Co., Tulsa

EVALUATION of the wellhead or lease-type processes will cover these classifications:

1. Stage separation over a wide range of operating temperatures.
2. Liquid processing, commonly referred to as "stabilization."
3. Adsorption recovery of liquids from high-pressure separator gas.
4. Combinations of these.

Gas-distillate wells with normal liquid contents as low as 1 bbl. per 1,000 M.c.f. to as high as 200 are common today. Therefore we have chosen to study three rather widely divergent but typical gas-distillate well streams. These are as follows:

1. Well stream A; "lean." 12 to 18 bbl. per 1,000 M.c.f. of well effluent.
2. Well stream B; "rich." 45 to 55 bbl. per 1,000 M.c.f. of well effluent.
3. Well stream C; "very rich." 145 to 165 bbl. per 1,000 M.c.f. of well effluent.

Presented under the original title, "An Evaluation of Methods Available to Increase Liquid Hydrocarbon Recovery Efficiency From Gas-Distillate Wells" at the New Orleans meeting of the API Division of Production.

The following matters will be considered with respect to each typical stream when produced with the aid of one, two, or all three of the process means outlined for providing differential increase in liquid recovery:

1. Efficiency goals for liquid recovery.
2. Operating conditions for optimum recovery, when obtainable.
3. Gross operating incomes generated by increased recovery efficiency.
4. Differential expenses associated with increased recovery.
5. The pattern for payback of increased investment.
6. The rate of return on the increased investment.

Throughout this article the initial separator pressure is considered to be 800 psia.

To prevent a distortion in our comparison we have expressed performance as a function of 1 M.M.c.f. of well effluent. Comparisons based on liquids recovered per unit of gas sold, without associated consideration of well effluent produced, make no proper accounting of gas lost to atmosphere.

"Stable stock-tank liquid" is defined as hydrocarbon liquid having a true vapor pressure of 12 psia. at 80° F., the mean stock-tank temperature experienced in the Gulf Coast area during summertime operations. This same liquid will indicate a vapor pressure of 18 psia. at 100° F.

Since the values of the hydrocarbons from gas-distillate wells are different depending on whether they are sold as liquid or as gas we must assign some individual money values to them. The gross price selected per barrel of stock-tank liquid is $2.93. The gross value of gas has been selected as 20 cents per M.c.f. When allowances are made for all taxes and royalty payments the stock-tank liquid has a net value of $2.33 per barrel, and the gas has a value of 15.2 cents. These net values are used throughout this study.

The assumption has been made that the gas evolved from the liquid as it is reduced in pressure on its way to

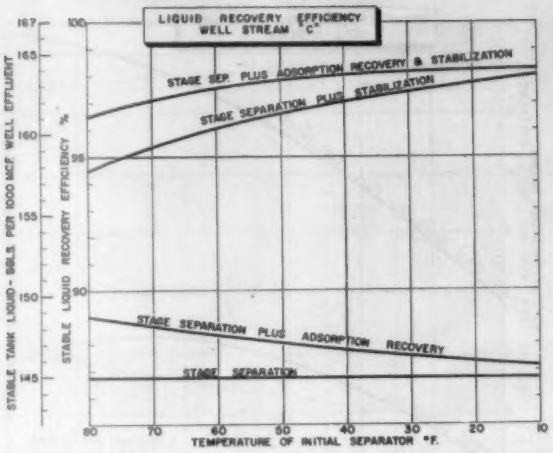

LIQUID RECOVERY EFFICIENCY
WELL STREAM "C"
STAGE SEP. PLUS ADSORPTION RECOVERY & STABILIZATION
STAGE SEPARATION PLUS STABILIZATION
STAGE SEPARATION PLUS ADSORPTION RECOVERY
STAGE SEPARATION
STABLE TANK LIQUID - BBLS. PER 1000 MCF WELL EFFLUENT
STABLE LIQUID RECOVERY EFFICIENCY %
TEMPERATURE OF INITIAL SEPARATOR °F.

Fig. 3

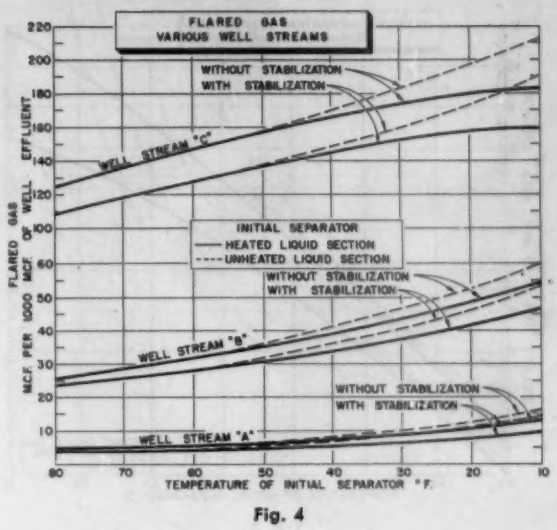


Fig. 4

from your gas-condensate wells

the storage-tank conditions is used as fuel or vented. It is realized that in some cases there would be an economic justification to compress the gas for sales but this requires individual attention for each application. Because the gas that is vented or flared has a net value of 15.2 cents per 1 M.c.f. this expense is considered in each study.

For the purposes of this study we have used designs of some high-performance-type adsorption recovery units. They may not necessarily be the optimum choice when all the economics are considered. But to eliminate as many variables as possible we have sized and priced adsorption units that will recover approximately 80% of the available stable stock-tank liquid contained in the high-pressure gas stream from separators operating at 80° F.

These same units when processing gas from separators operating at the 10° F. level will recover approximately 40% of the available stable liquid in the feed stream. This selection reduces the complexity of the comparison, yet does not rob it of realism.

Liquid-Recovery Efficiency

With the field of discussion defined, let us first establish some goals or plateaus of efficiency which can be achieved with the process methods under study.

Fig. 1 shows the stable stock-tank liquid-recovery efficiency as a function of initial separator temperature on well stream A. Stage separation is the first building block towards efficiency increase. Stage separation plus "stabilization" is the second, stage separation plus adsorption recovery the third, and stage separation plus adsorption recovery and stabilization the fourth.

An examination of Fig. 1 will show that when we use all of the available processes combined it is possible at temperatures of 10° F. to obtain a recovery efficiency as high as 94% of the stable stock-tank liquid in the well effluent. With the same equipment but operating at a temperature of 80° F., and designed with like facility, a recovery to the order of 86% of the stable tank liquid in well stream A is obtained.

Fig. 2 presents the same information on rich well stream B. It indicates that liquid recovery efficiencies from 92% at 80° F. to 98.3% at 10° F. are obtainable with the use of all the available equipment types in use.

Note the relative value of these segmental efficiency increases. The time-tested tools, low-temperature separation and stabilization, are the greater contributors. This emphasizes why the use of low temperature separation and stabilization is a well established production practice.

Fig. 3 presents the liquid-recovery efficiency information on the very-rich stream C. It indicates again the great importance of stabilization in the over-all program of maintaining high efficiencies. The present-day tools used to their best advantage will, when applied to a very-rich stream such as the one under consideration, recover 91½ % of the stable stock-tank liquid at 80° F. or 97% at 10° F. It must be remembered that we are considering for the present only liquid-recovery efficiencies.

The temperatures obtainable by virtue of wellhead pressure expansion is a function of wellhead flowing temperature, wellhead pressure, the liquid content of the stream, and the limitations of equipment selected for the application.

In reviewing the information presented in Figs. 1, 2, and 3, note the effect of the initial separation temperature on the recovery efficiency from these three streams. The lean stream or A is the most sensitive to changes in the initial separation temperatures when stage separation only is used. At 80° F., 60% of the stable liquid is recovered. At 10° F., 78½ % of the stable liquid is recovered. Well stream B is less sensitive to the influence of initial separation temperature and 80° F. produces 80% efficiency while 10° F. produces 86½ % efficiency. Stream C is insensitive to a change in separation

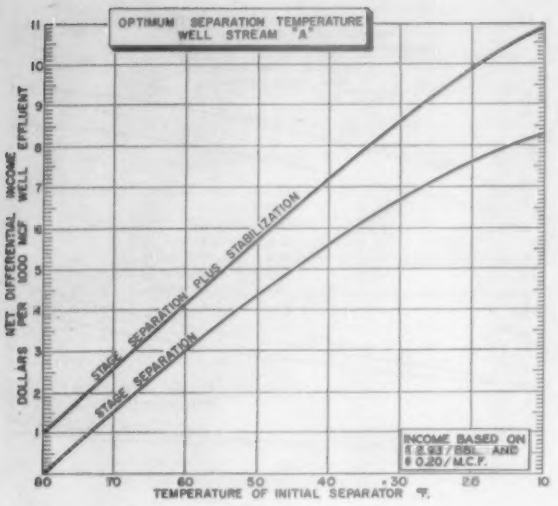


Fig. 5

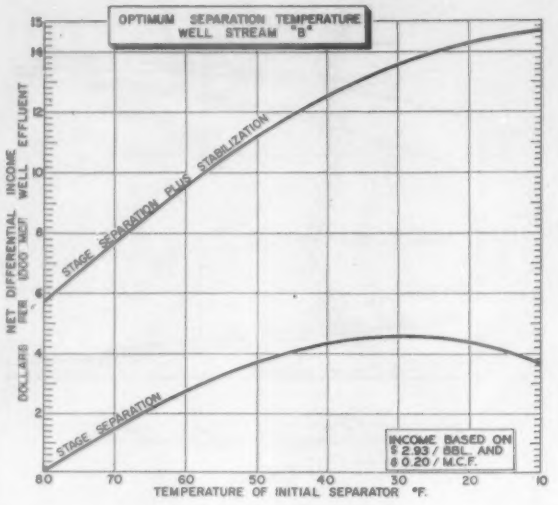


Fig. 6

temperature when the recovery of liquid is the **only** element to be considered. The liquid-recovery efficiency at 80° F. with stage separation **only** is the same as it is at 10° F.

An examination of the relative values of stabilization will reveal that the order of magnitude of the value of this segmental increase in liquid recovery efficiency is of a reverse order. That is, well stream C indicates the greatest sensitivity and the greatest gain from liquid processing, 15%. But on well stream B an approximate average of only 7% is indicated. In well stream A a much smaller average of 3 to 4% exists.

During the review of Figs. 1, 2, and 3 showing the liquid recovery efficiency levels possible, it is important to assess the value of adsorption recovery of liquid from the gas high-pressure separator. An examination of the recovery efficiency curves will show this. As the benefits derived from low-temperature separation decrease because of the inability of the wellhead flowing pressure to produce low separation temperatures, the liquid-recovery efficiency tends to be maintained at a high level by the use of adsorption processes.

Optimum Separation Conditions

Thus far we have concerned ourselves only with establishing the order of magnitude of efficiencies which we may obtain. We have not considered the recovery expense, nor have we studied how economics may influence even such things as the choice of initial separator temperature.

Fig. 4 provides the initial means for doing this. It shows the quantity of gas flared from the intermediate stages of separation as a function of well-stream composition and temperature of the initial separation.

For the lowest separator temperature being considered the lean stream A vents only 10,000 to 13,000 cu. ft. of gas per 1,000 M.c.f. of well effluent. Well stream B vents 46,000 to 55,000 cu. ft. These values are those calculated for low-temperature-separation equipment wherein the liquid storage portion of the low-temperature separator is heated. If, on the other hand, the liquid were allowed to leave the separator at the same temperature at which separation took place the vented gas would be that indicated in Fig. 4 by the broken lines and would be much higher in value. For the purposes of this study reference is made only to that type of equipment which provides heat to the liquid in storage in the low-temperature separator.

Fig. 5 plots the net differential income in dollars per million cubic feet of well effluent as a function of the temperature of the initial separator. The "net differential income" is the income over and above that which would have been generated with conventional stage separation at 80° F. That usage applies throughout this entire discussion.

Note that the lean stream A at temperatures below 10° F. yields the greatest dollar income. Likewise the value of stabilization is more significant at the lower temperatures than it is at temperatures in the order of 80° F.

Fig. 6 plots the same type of information for well stream B. The greatest net differential income, when stage separation only is used, occurs at a temperature of 30° F. If stabilization equipment is used the separator if possible should be operated at a minimum temperature of about 10° F. The net differential income values for stabilization on the B stream are much greater than those for the lean stream.

Fig. 7 is a plot of the same type of data on the very-rich stream C. This is an example of the widely divergent characteristics of gas-well effluents. In this stream low-temperature separation is not beneficial. The differential quality and value of the flare gas more than offsets the increased liquid recovery. Therefore the net differential income as a result of low-temperature separation is negative. There is a significant increase, however, through the use of stabilization equipment. For the greatest income per unit of well effluent on any stream similar to this stream C it would be advisable to operate the separator at 80° F. and employ liquid processing or stabilization.

Initial Economic Consideration: Separation and Stabilization

An initial measure of investment desirability is the payback period in years. The simple consideration of payback periods for economic classification does not weigh the value of the operating income over a period of time in terms of its present value as if it were available in a lump at the beginning of the producing period under study. Nor does it consider the variations of income with time.

Nevertheless, such "coarse screening" is adequate for an initial spotting of comparative investment desirability. So several patterns of payback for the various combinations of well-producing equipment have been made. All are based on operations at un-

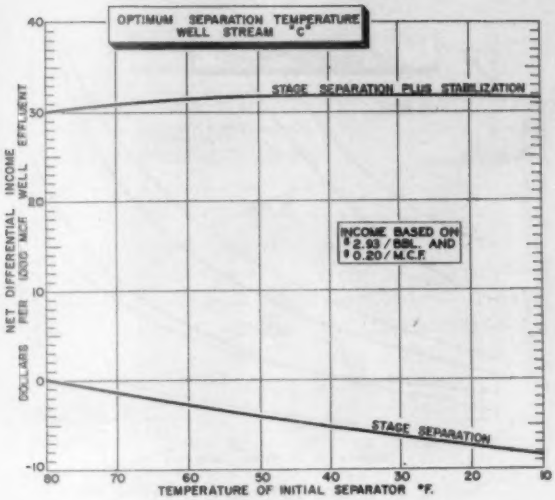


Fig. 7

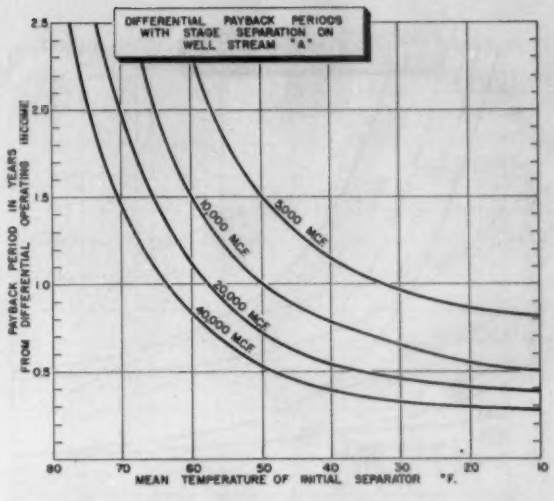


Fig. 8

changing conditions during the payback period.

Table 1 outlines for one case only those data obtained to plot typical fixed-condition payback patterns; it covers one case using stage separation and one with stabilization added. These examples apply only to stream B at constant operating conditions set by the cold separator in operation at 30° F. and 800 psi. Similar data for streams A and C at temperatures of 10° through 80° F. at 10° increments have been prepared and the results plotted.

Payback Patterns: Stage Separation and Stabilization

Payback periods are calculated for 32 cases on each of these streams, just as shown on the Table 1 example.

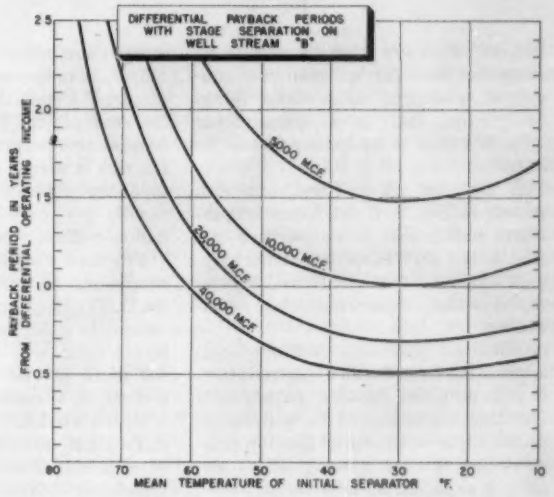


Fig. 9

TABLE 1—PAYBACK PATTERN DATA FOR STAGE SEPARATION AND STABILIZATION

CONDITIONS:

Well stream	B
Flow rate	20,000 M.c.f.
Separator pressure	800 psia.
Separator temperature	30° F.

DATA:

		Cold separation	Cold separation plus stabilization
(1)	Differential recovery	58	150
(2)	Differential gross income	$ 135.00	$ 230.00
(3)	Differential operating expense	51.00	42.00
(4)	Net differential income	84.00	308.00
(5)	Differential investment	22,000.00	44,230.00
(6)	Payback period, years	0.7	0.4

TABLE 2—PAYBACK PATTERN DATA FOR HYDROCARBON ADSORPTION EQUIPMENT

CONDITIONS:

Well stream	B
Separator pressure	800 psia.
Separator temperature	30° F.

DATA:

(1)	Flow rate	20,000 M.c.f.
(2)	Gas-feed rate	18,200 M.c.f.
(3)	Unit price	$64,000.00
(4)	Daily gross income	80.50
(5)	Operating expense	31.70
(6)	Net income	49.30
(7)	Payback period	3-5 years

Figs. 8 and 9 plot the differential payback periods when stage separation only is used at various temperatures. It is interesting to note that this plot, while it was derived on the basis of specific recovery increases at various separator temperatures, is usable on the basis of **mean** temperature of the cold separator during the period under consideration. For equipment such as cold stage-separation units this is possible only because the original equipment cost and expense of operation do not vary widely with well conditions which lead to increasing temperatures.

The coarse-screen economics picture for various flow rates at varying temperatures on streams A and B show that:

(1) On lean stream A, Fig. 8, cold-separation plants from 5,000 M.c.f. per day upward operating over the entire range of normal cold-separator operation (somewhere between 10°

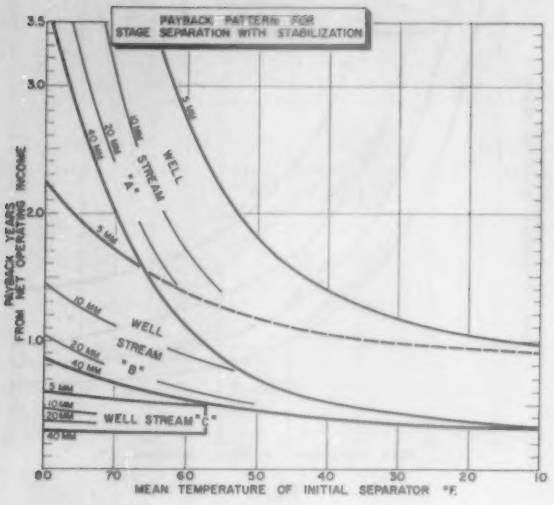


Fig. 10

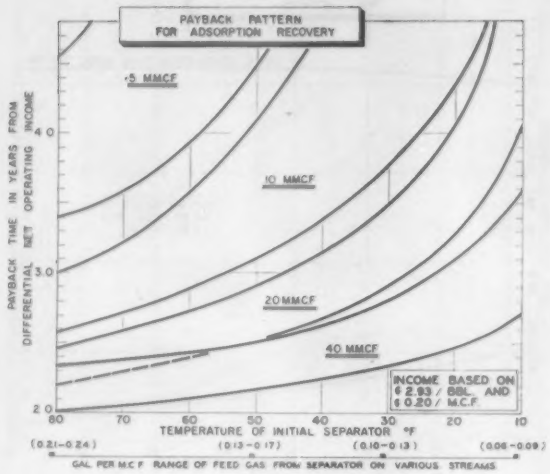


Fig. 11

and 45° F.) have payback periods so short that little further economic consideration need be made. Other things being equal, there is no question but what this class of equipment should be installed.

2. On the other hand, on rich stream B, Fig. 9, if the mean temperature during the entire payback period is not 40° F. or below the payback on the 5,000-M.c.f. cold-separation differential investment may be excessive.

While not positively excluding such application from further consideration, it indicates the possible requirement for finer screening. This will be especially true when initial flowing pressures are low or when pressure decline is expected to be great.

3. On rich stream B there is little question about the economics of the 10,000, 20,000, and 40,000-M.c.f. units regardless of the mean separating temperature within the normal range between 10° and 45° F. during the payback period and beyond.

4. When one considers that all of the studies made herein are based on payback from differential income-tax and applicable allowances, it can be seen that further close screening is indicated on applications in the 1½ to 2-year-plus range.

5. Payback pattern for cold stage-separation equipment on streams typified by very rich C are completely discouraging. The differential operating income over stage separation is essentially zero and the payback period is of course infinite. Indeed because of flare-gas increases the income below 60° F. operating conditions is less than with conventional stage separation.

Fig. 10 plots similar date with respect to the combination of cold-separation equipment and a so-called stabilizer. It makes a somewhat different picture. Using the point taken for the example on Table 1, for a mean separating temperature of 30° F. on the rich B stream with a 20,000-M.c.f. unit, the payback period is approximately 0.4 years or less than the situation without the stabilizer.

For lean stream A, considering the small size of income after payback, the 5,000-M.c.f. cold stage-separation units with stabilization added are questionable, or at least indicate the need for more precise examination before a decision is made.

For very-rich stream C the entire differential income is due to the use of stabilization equipment, cold stage separation having been disqualified. Thus the data extend only to separation temperatures as low as 58° F. or so. The payback rate is outstanding. But it should be recalled that in figuring the investment for stabilization in this separator-temperature range it was necessary to include an ample amount for provision to cool the kettle product. This will always be the case.

It is well to recall at this point that one cannot compare payback periods directly without considering the size of the initial investments. This is another reason why the payback study can only be construed as a first step in over-all economic analysis of available combinations of equipment on gas wells today. The comparison of payback periods for stage separation alone with those for stage separation plus stabilization is a case in point.

Even though two situations compared may have a 1½-year payback period, the investment in the case of the stabilization plus separation is so much larger that it indicates proportionately larger continuing income in the life beyond payback periods. This is obviously known by all but frequently overlooked in fast-draw economic considerations.

Initial Economic Considerations: Addition of Adsorption Equipment

Table 2 is typical of the fixed-condition data accumulated for obtaining payback pattern on the added hydrocarbon-adsorption equipment.

The numbered items on the tabular example may be further clarified respectively as follows:

1. The "flow rate" of 20,000 M.c.f. is well-effluent rate.

2. The "gas-feed rate" of 18,200 M.c.f. is the quantity of gas from the cold separator at 30° F. and 800 psi. on stream B.

3. The "unit price" is the price installed with desiccant in place.

4. The "daily income" is the gross dollar equivalent at $2.33 net per barrel for the salable stable material recovered at the stock tanks.

5. The "operating expenses" are many. For example, take these daily figures:

(a) Expense of flare gas not salable	$5.12
(b) Expense for gas required for fuel in excess of that available from the medium-pressure flare	$7.88
(c) Expense of maintenance based on 3% of the initial investment	$5.50
(d) Bed replacement expense is based on replacing the bed once a year at a delivered and installed cost of 32 cents per pound of desiccant	$8.00
(e) Labor expense	$5.20

Payback Patterns: Addition of Adsorption Equipment

Payback characteristics for the added hydrocarbon-adsorption equipment itself are most broad as shown

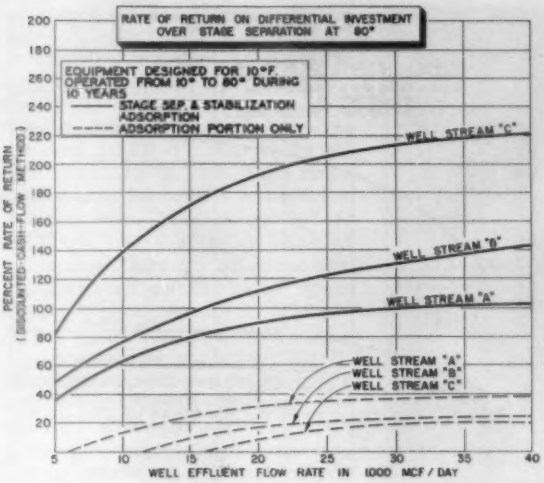
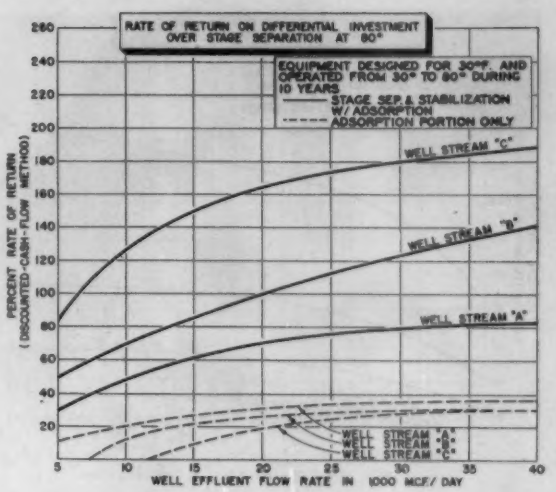

RATE OF RETURN ON DIFFERENTIAL INVESTMENT OVER STAGE SEPARATION AT 80°
EQUIPMENT DESIGNED FOR 10°F. OPERATED FROM 10° TO 80° DURING 10 YEARS
STAGE SEP. & STABILIZATION
ADSORPTION
ADSORPTION PORTION ONLY
WELL STREAM "C"
WELL STREAM "B"
WELL STREAM "A"
WELL STREAM "A"
WELL STREAM "B"
WELL STREAM "C"
PERCENT RATE OF RETURN (DISCOUNTED-CASH-FLOW METHOD)
WELL EFFLUENT FLOW RATE IN 1000 MCF/DAY

Fig. 12a


RATE OF RETURN ON DIFFERENTIAL INVESTMENT OVER STAGE SEPARATION AT 80°
EQUIPMENT DESIGNED FOR 30°F. AND OPERATED FROM 30° TO 80° DURING 10 YEARS
STAGE SEP. & STABILIZATION W/ ADSORPTION
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WELL STREAM "C"
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WELL STREAM "A"
WELL STREAM "A"
WELL STREAM "B"
WELL STREAM "C"
PERCENT RATE OF RETURN (DISCOUNTED-CASH-FLOW METHOD)
WELL EFFLUENT FLOW RATE IN 1000 MCF/DAY

Fig. 12b

in the pattern plotted on Fig. 11. This in itself indicates the desirability of further detailed economic studies for this class of equipment. By its very nature it involves a greater investment and a longer payback period. Also, we face the complexity of a varying operating income with time, limited only by the maximum temperature that the separators attain and the ability of the equipment to operate effectively as conditions deviate from those chosen originally.

However, for purposes of this initial payback study, 48 units considered for predicting returns were selected and the payback figured as though the equipment were installed and used during the entire period at the exact conditions existing at the time of installation. On units taking feed directly from stage separators where cold separation is involved, this of course is not the true condition. Nevertheless at this point we are working only a pattern-type analysis so this assumption will not spoil the viewpoint.

Fig. 11 shows that payback times on units with a capacity less than 20,000 M.c.f. per day are such as to require a closer examination before installation. This is true in view of payback time exceeding 3 to 3½ years. For this particular case, in consideration of a less than 1 year payback time for stage separation and stabilization, Fig. 11 suggests that the investment involved for the hydrocarbon-adsorption equipment compared to its differential income is not attractive. This, however, is not a positive analysis until further studies as outlined here have been accomplished.

In order to provide a basis for direct comparison, the payback patterns on the adsorption units are also based on income per 1,000 M.c.f. of well effluent. For instance on the lean A stream a nominal 20,000-M.c.f. adsorption unit is actually processing 19,540 M.c.f. per day from the cold separator operating at 30° F.

So in this case the unit is handling essentially the nominal flow. On the other hand, a unit operating at 30° F. on the very-rich stream C will only have to handle 13,000 M.c.f. per day.

More Detailed Economic Considerations

Unless the payback period is spectacular in its brevity, the more basic interest of the producer will be in the pattern of net income during those years between payback and the end of the production project. Also a close analysis must consider not only the actual income during the life period under consideration, but actually the true flowing value of that deferred income. That is to say, its value on a present-day basis.

To do this a study of the rate-of-return on investment and the present worth of the generated profit before taxes during the life period must be made. One of the best approaches to this is the discounted-case-flow method. It weighs the pattern of future earnings and provides a means for relating them to any other investment considered.

Such a study is considered mandatory whenever equipment such as hydrocarbon absorption assemblies are being used on gas wells in combination with other equipment less difficult to analyze. This is because the pattern of income from differential increases of salable products over the period under study may be widely variable. It is a mixture of declining income from cold separation, which is becoming ever less effective, with inclining income from an adsorption recovery unit which becomes more effective with time.

If one should apply a hydrocarbon-adsorption unit to the gas from a cold separator at 30° F. at some given moment in time, then at that moment there is a certain differential income rate in excess of stage separation. This results from the combined effects of cold separation, stabilization of the separated product, and the adsorbed hydrocarbon liquid from the cold separator gas. At this time the adsorption equipment may be designed for the quality of stream emanating from a 30° F. separator, or it may be designed to match gas-quality conditions later in the life.

If, for instance, the adsorption equipment is designed for the initial gas quality, then as time goes on the differential income from cold storage separation becomes less and less, so the material available to retain by stabilization becomes less. Yet at the same time the feed to the hydrocarbon adsorption unit becomes richer. In spite of the built-in ability of the adsorption unit to adjust, the over-all efficiency of recovery will decline. We will be getting a lesser proportion of adsorbed products from an ever-richer stream.

The composite effect of these things can only be studied by a moment-to-moment look at income over the period, say 10 years, and then integrating the whole into a figure which can be used as a basic comparator; a figure which will weigh the value of the composite investment in equipment as compared to other types of equipment or other forms of investment available to the operating company.

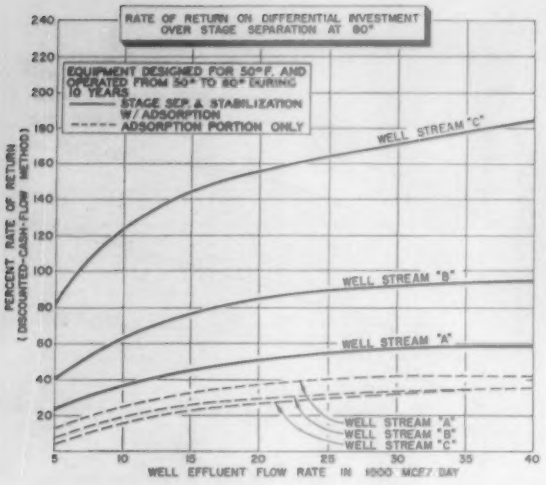

RATE OF RETURN ON DIFFERENTIAL INVESTMENT OVER STAGE SEPARATION AT 80°
EQUIPMENT DESIGNED FOR 50° F. AND OPERATED FROM 50° TO 80° DURING 10 YEARS
STAGE SEP. & STABILIZATION W/ ADSORPTION
ADSORPTION PORTION ONLY
WELL STREAM "C"
WELL STREAM "B"
WELL STREAM "A"
PERCENT RATE OF RETURN (DISCOUNTED-CASH-FLOW METHOD)
WELL EFFLUENT FLOW RATE IN MCF/ DAY

Fig. 12c

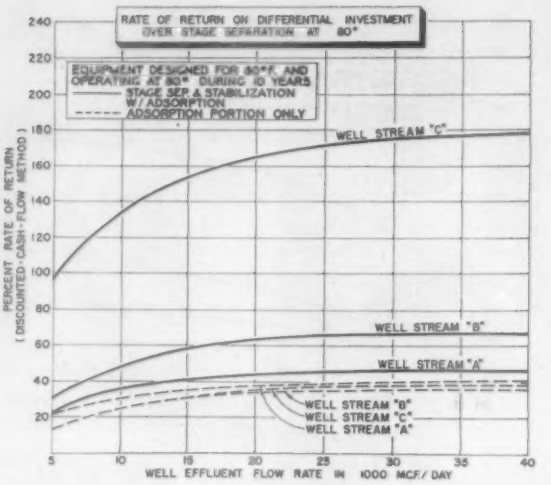

RATE OF RETURN ON DIFFERENTIAL INVESTMENT OVER STAGE SEPARATION AT 80°
EQUIPMENT DESIGNED FOR 80° F. AND OPERATING AT 80° DURING 10 YEARS
STAGE SEP. & STABILIZATION W/ ADSORPTION
ADSORPTION PORTION ONLY
WELL STREAM "C"
WELL STREAM "B"
WELL STREAM "A"
PERCENT RATE OF RETURN (DISCOUNTED-CASH-FLOW METHOD)
WELL EFFLUENT FLOW RATE IN MCF/ DAY

Fig. 12d

That figure is the "rate-of-return" discussed later. A simple consideration of payback is here obviously not going to get the job done.

Let us review the discounted-cash-flow method for determining the rate of return on the investment required to produce the differential increase in recovery efficiency. It will be recalled that the discounted-cash flow method is based simply on the philosophy that we are investing capital today and that this investment is actually buying for us a series of future annual incomes over a period of time, say 10 years.

What we are doing in effect is finding an interest rate which will discount that 10 years' worth of future incomes to present value, as though they were available to us for reinvestment use at the moment.

In order to get a comparative picture of the same situation then, we have selected four cases.

1. The first case considers the installation of adsorption equipment along with cold stage separation and stabilization at 10° F. separator operating condition and gas-feed quality. In this case the adsorption equipment is designed for fully loaded optimum operation with feed from a 10° F. separator.

The entire system is allowed to operate as well pressure falls and separator temperature rises during a period of 10 years, the last year of which experiences separator operation at 80° F., Fig. 12a.

2. The second case is one in which initial installation of adsorption equipment is made for feed quality at the point where the cold stage separator is at 30° F. Then the operation viewed as above during 10 years as the temperature rises, Fig. 12b.

3. In like manner a third study is completed for installation at 50° F. operating over 10 years up to 80° F. operation, Fig. 12c.

4. The last example considers design and installation of the equipment at 80° F. operating under constant conditions for 10 years at 80° F. In all the above studies the rate of return on the entire composite equipment investment is plotted in comparison with a plot of the return rate on that portion of the investment required for the added adsorption equipment itself. Thus the latter can be viewed separately in order to weigh the true value of that increased investment, Fig. 12d.

The information which can be extracted from rate-of-return correlations such as in Figs. 12a, b, c, and d, is too voluminous here to summarize in detail. Such correlations if carefully interpreted can be used for specific comparison purposes as well as to establish convenient working generalizations usable for guiding general policy.

It will be up to the individual producer to set his own limits on acceptable rates of return in consideration of his own financial structure, other investment opportunities, case position, and tax situation. There are, however, some observations which should be pointed up in summary now.

The discounted value of deferred income earned 3 years after investment, say for some hydrocarbon efficiency-increasing project, amounts to more than the same value of actual income earned in the sixth year after the project begins. This is the very basis for the derivation of the rate-of-return parameter based on the present worth of deferred net income.

It can thus usually be concluded that the design basis for adsorption recovery equipment should be such as to provide optimum recovery of available material from the gas feed early in the project and leave inefficient operation, if unavoidable, to the later life, regardless of the gradual enriching of the feed stream.

While stream C would not justify cold-stage separation, Figs. 12a and 12b are plotted for that stream as well as streams A and B. It is thus possible to obtain an over-all view of wellhead setups with adsorption units included on all three streams at initial feed qualities of gas from 10° and 30° F. separators. Further with respect to the C stream, Figs. 12c and 12d provide an adequate investment value to cover the necessary cost of an outside coolant source for the stabilizer product.

Let us now check an example of this nature from the correlation presented on the four plots of Fig. 12. We have, for instance, 20,000 M.c.f. of well stream B. Cold-separation operation is possible at a 30° F. separator temperature. Such installation is found economically feasible. The addition of stabilizing equipment is firmly justified for good operation over a period of time well beyond payback and not before which time there will be any necessity for further investment to provide added outside coolant for the kettle product. So these two process tools are installed.

With this plan, however, in a short period of time after installation the temperature will have risen to the point where dehydration as a result of cold separation is no longer possible.

Some sort of provision for replacing the dehydration effect will have to be made. Quite obviously the stream contains an ample supply of adsorbable material to make the installation of hydrocarbon adsorption

equipment a consideration in its own right.

Now the question arises as to whether the adsorption equipment should be installed at the moment, based on feed-gas quality from a cold separator at 30° F.; then to let the unit operate on an increasingly richer feed stream, but with a less-efficient recovery basis, back to the 80° F. conditions, say during 10 years; or whether to forego cold-separation equipment altogether, install stage-separation equipment for 80° F. operation, augment the setup with stabilization, provide a product-cooling facility initially, and design the hydrocarbon-adsorption equipment for operation at 80° F.

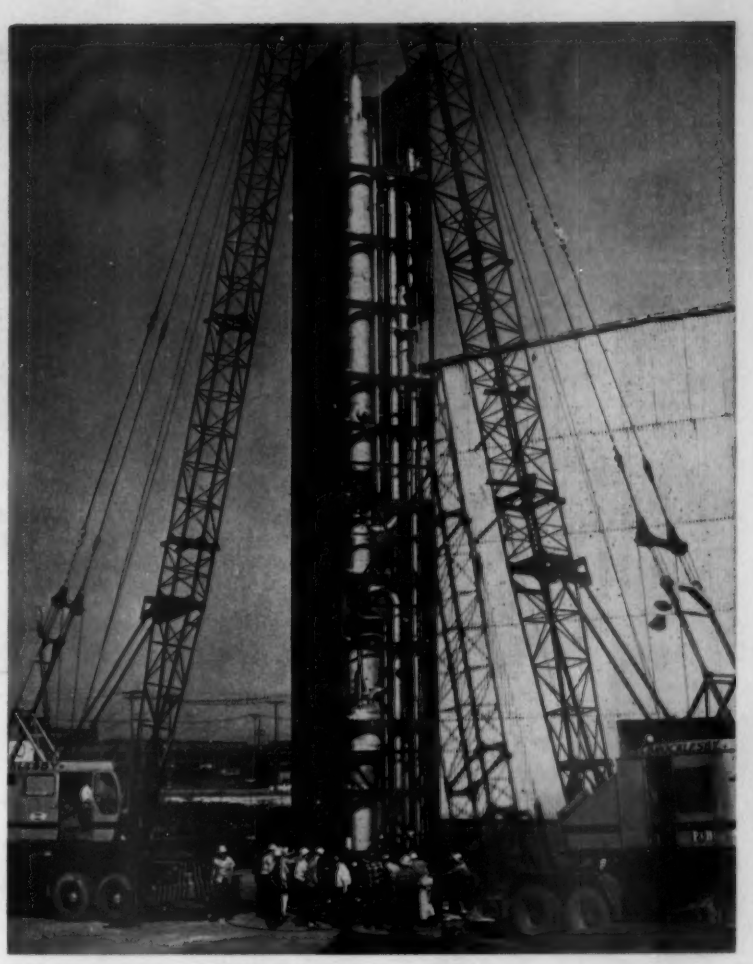
From the standpoint of the adsorption equipment alone it may be possible to follow through the economics of the application by direct reasoning. But from the standpoint of the combination of differential incomes involved in cold separation, stabilization and adsorption over the varying conditions during the 10 years, our best approach to the problem is by consideration of relative rate-of-return.

In our example case, if we design the equipment for 30° F. feed quality operation, install cold separation and stabilization and let the whole system operate as pressures decline, our rate-of-return on the necessary differential investment will be 100%.

On the other hand, if we give up the idea of cold separation and install conventional separation at 80° F. and "stabilization," the required product cooling facilities plus the adsorption unit designed for 80° F., we will again have our required dehydration and good efficiency, but the return will be only 65%.

Similar questions as to whether or not adsorption equipment should be designed for end conditions or initial conditions can be equally readily worked out if a moment-to-moment cash flow study is followed and appropriate discounting back to present worth is made.

A host of such examples are possible to cite. But one common conclusion appears to be this: When applied in the role of increasing over-all hydrocarbon-recovery efficiency in connection with gas-well producing systems, adsorption recovery equipment supplements in a vital way but does not supplant the low-temperature-separation process. The wise combined application of these methods can be used to the great good of the producer on a hydrocarbon-recovery basis alone, not to mention the wide range of justification possible with respect to their respective and supplementary dehydration roles.



Eight stories high, this 60-ton section of an unusually large packaged type low-temperature gas-separation plant starts on its way to Long Beach, Calif. It will be installed at American Chemical Corp.'s chlorinated-hydracarbon manufacturing center. The splitter column of the unit contains an unusually large number of specially designed trays, weighing 17,000 lb. All the various vessels and associated piping are of stainless steel fabricated by electric-arc welding.

The unit was designed and built by American Air Liquide.

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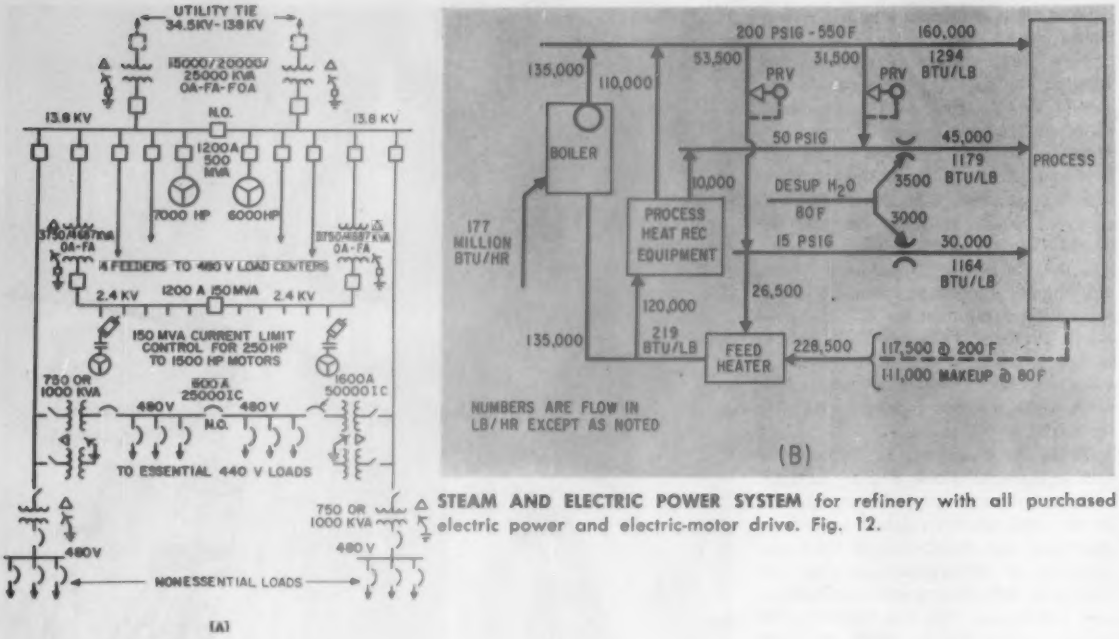


STEAM AND ELECTRIC POWER SYSTEM for refinery with all purchased electric power and electric-motor drive. Fig. 12.

How to select your drive system

- An over-all look, in which the steam and power requirements for processes in adjacent areas can be included in a refinery or chemical-plant steam and power-system study, may result in a very attractive saving in costs.

PART 2 OF TWO PARTS

BY W. B. WILSON AND I. H. LANDES
Industrial Engineering Section,
General Electric Co., Schenectady, N. Y.

THERE IS an increased awareness that selection of the drive system must be started early in the process-design stages.

Process engineers can often find areas in the process where economies can be realized by carefully integrating the driver into the process system. To do this, the engineer must have a thorough knowledge of the many capabilities and operating characteristics of the different types of drivers available. By use of short-cut methods, the engineer must be able quickly to recognize the least attractive drive system so that adequate time is available to study the few remaining alternates in the detail required for final selection.

Plants requiring large amounts of steam at 250 psig. or below may find it economic to replace obsolete and inefficient boilers with a combination of higher-pressure boilers and large mechanical-drive or generator-drive turbines. These turbines can generate low-fuel-cost horsepower or kilowatts when extracting or exhausting the steam required for process or as supply for smaller or existing low-pressure turbines.

When studying alternative drive arrangements the effect of any changes in associated equipment to provide the necessary operating flexibility, such as throttling valves or fluid couplings, must be taken into consideration. It is the differential cost of the entire system, including the drivers, that must be evaluated if the drivers selected are to result in maximum profits for the plant.

A few of the other factors that should be included in an over-all evaluation include:

1. What are the probable future changes in fuel and electric-power costs?

2. Can requirements of processes in adjacent areas be included in the study of major drivers to effect over-all plant economies?

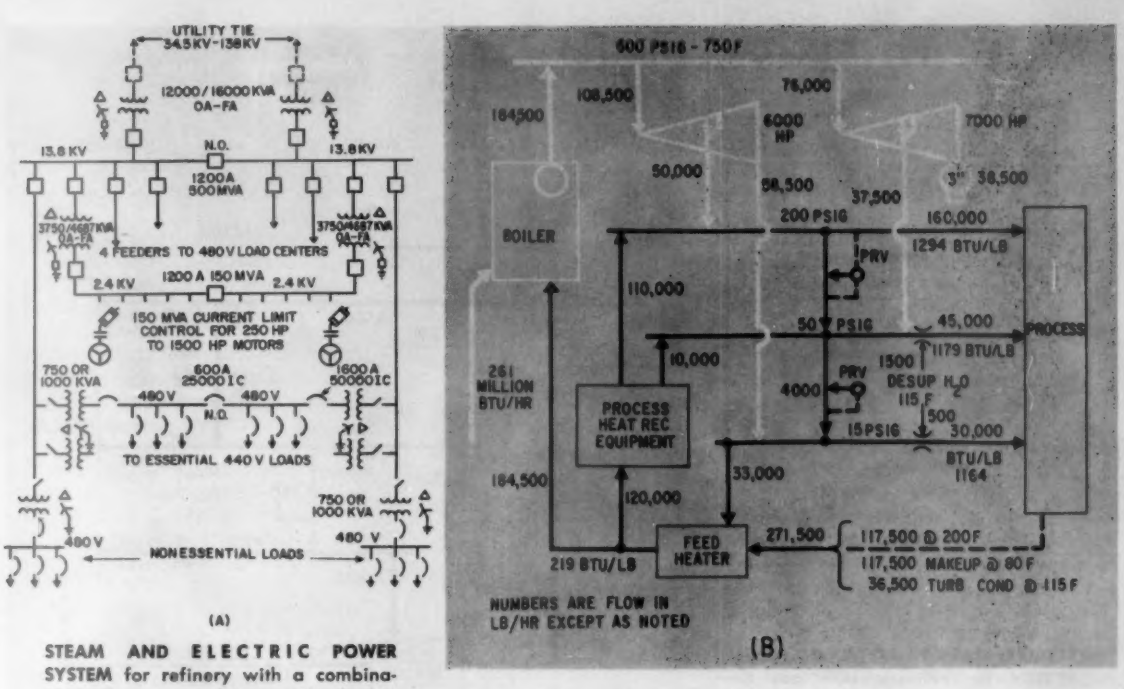
3. Can a combination of turbine-generator and mechanical-drive turbines be integrated into the process system to make a more economic over-all steam and power system?

Case Study

To illustrate some of the considerations for drive selection, let's look at an actual system. The steam and power requirements assumed for the refinery used in this example are tabulated in Table 2.

The example assumes a refinery requiring a total of approximately 235,000 lb. per hour of process steam at 200, 50, and 15 psig. About 120,000 lb. per hour of this steam can be obtained from heat-recovery equipment in the process area, leaving 115,000 lb. per hour to be furnished from fuel-fired boilers. The process also requires approximately 39,000 hp. with the four larger drives being rated 7,000, 6,000, 1,500, and 1,200 hp.

Three alternative drive systems are included to indicate savings in fuel and power costs that can be expected when drive systems having different initial investment costs are considered. Obviously, more than three alternates could have been included, but to conserve time and space, this discussion



STEAM AND ELECTRIC POWER SYSTEM for refinery with a combination of steam turbines and electric-motor drives. Fig. 13.

is limited to the more attractive alternates.

All-electric motor drive . . . This is Alternate 1. If lowest investment cost is the only criterion and purchased electric power is available at the plant site, electric motors and low-pressure process boilers would be selected to provide the assumed refinery requirements. One-line diagrams showing the electrical system and the boiler system are shown as parts A and B of Fig. 12. Investment costs, as well as the annual fuel and electrical costs, are also shown in Table 3.

The heart of the electrical system for this refinery is the 13,800-volt plant distribution system supplied direct from two separate utility sources through two transformers of equal rating. The forced-oil, forced-air, cooled (FOA) rating of the transformers was selected to permit operation of the refinery at essentially rated capacity even though one incoming source of power is out of service. This permits inspection and maintenance of the incoming power transformer and breaker or the utility transmission circuit as required to maintain optimum service reliability.

The same substation sizing philosophy can be extended to the 2,400-volt and 480-volt secondary selective systems. With a knowledge of individual maintenance and operating practices as well as the consequences of curtailing power on any individual utilization bus, it can be decided whether each transformer should be sized to permit inspection and maintenance of its companion transformer and power supply circuit without taking off some of the connected motor load.

Some of the nonessential 480-volt loads are fed by radial instead of secondary selective load center substations.

Since 1,500 hp. was the largest 2,300-volt motor, motor control equipped with high-interrupting-capacity current-limiting fuses was used. The 2,400-volt substation has metal-clad secondary breakers and a tie breaker between load buses.

Some of the larger 440-volt motors utilize breakers for starting, and are connected directly to the substation bus. A large portion of the 480-volt substation load is distributed over short feeders to grouped motor control. Because only drivers above 1,000 hp. are being compared in this article, the 480-volt system is the same for

TABLE 2—ASSUMED REQUIREMENTS FOR 50,000-BBL. PER DAY REFINERY

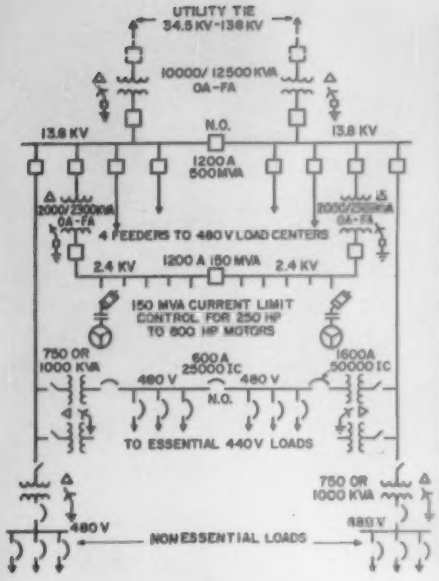
Steam requirements—	Required for process	Recovered from process equipment	Net required
At 200 psig.—550° F.	160,000	110,000	50,000
At 50 psig. (sat.)	45,000	10,000	35,000
At 15 psig. (sat.)	30,000	.....	30,000
Total (without feed-water heating)	.....	.....	115,000

Mechanical drivers—	Installed capacity, hp.	Normal operating load, hp.
Cat cracker main air blower	7,000	7,000
Cat cracker main gas compressor	6,000	6,000
Reformer recycle compressor	1,500	1,500
Cat cracker transport air blower	1,200	1,200
Lot of miscellaneous motors (1,000 hp. and below)	23,000	14,000

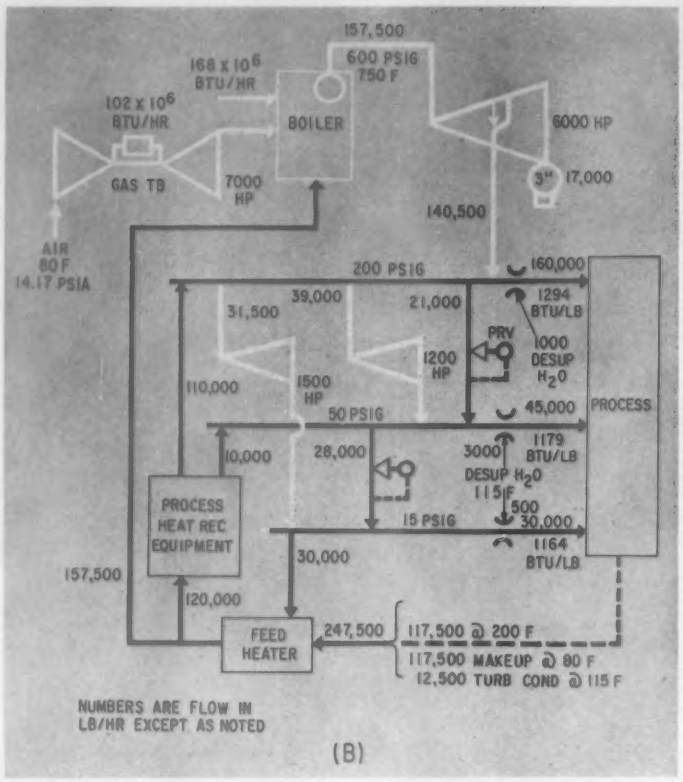
TABLE 3—COSTS FOR ELECTRIC-MOTOR DRIVE AND ALL ELECTRIC POWER PURCHASED

Investment	
Transformers and load centers	$ 760,000
Switchgear and control	585,000
Motors and gears	1,280,000
Steam boilers	1,100,000
Total	$3,725,000

Fuel and Power Costs	$/Hour	$/Year (8,000 hr.)
Fuel—177 M.M.B.t.u./hr. at 30 cents	53.10	425,000
Electricity—25,000 kw.-hr. at 8 mills	200.00	1,600,000
Total		$2,025,000



(A)



(B)

STEAM AND ELECTRIC POWER SYSTEM for refinery with gas turbines, steam turbines, and electric-motor drives. Fig. 14.

all alternates. Even though included in over-all investment costs, the cost of the 480-volt motors, lighting, etc., is a constant for all alternates and the absolute cost does not affect the differentials used in evaluating different large driver systems.

Since economic speeds of the larger motors do not often match the speed of compressors and other driven equipment, it is necessary to use a combination of motor and stepup gear to give the desired output shaft speed. You will note that gears have been included in the summary of investment costs. In addition, from a practical operating standpoint, throttling valves, bypass lines, inlet guide vanes, and other equipment modifications may be required to get the process flexibility required when using electric motors.

Nothing is included in investment costs for these modifications. Cable for the electrical system and steam lines outside the boiler plant have not been included because, even though they may be sizable items of cost in themselves, they do not often have a significant effect on the difference in cost in preliminary comparison of alternates such as included in this case study.

Steam turbines and motor drive . . . This is Alternate 2. The 6,000 and 7,000-hp. motors in Alternate 1 are replaced by automatic extraction turbines, and the 200-psig. boilers are also replaced with 600-psig. boilers, as shown in Fig. 13. Table 4 shows investment and operating costs for this system.

The turbines have flow capability to provide the low-pressure steam required with a minimum of flow through the reducing valves. To simplify the diagram, the pressure-reducing valve and desuperheating station between the 600-psig. and 200-psig. systems has been omitted in Fig. 13B. A pressure-reducing valve (PRV) would normally be installed here to permit supplying the 200-psig. steam system from the 600-psig. system at any time that the 6,000-hp. turbine is out of service.

TABLE 4—COSTS FOR COMBINATION OF STEAM TURBINES AND MOTOR DRIVES

Investment

Transformers and load centers	$ 730,000
Switchgear and control	560,000
Motors and gears	830,000
Boilers	1,600,000
Turbines	615,000
Cond. and cooling tower	265,000
Total	$4,600,000

Fuel and Power Costs

	$/Hour	$/Year (8,000 hr.)
Fuel—261 M.M.B.t.u./hr. at 30 cents	78.30	$ 625,000
Electricity—14,830 kw.-hr. at 8 mills	118.65	950,000
Total		$1,575,000

The dual function of the PRV between the 200 and the 50-psig. systems, coupled with action of the two extraction turbines, permits greater operating flexibility than may at first be apparent. For instance, a decrease in demand for 15-psig. steam will initiate action to start closing the 50/15 reducing valve. If the 15-psig. steam load is reduced further, after the PRV flow is reduced to zero, the governor on the 6,000-hp. automatic extraction noncondensing turbine will automatically decrease exhaust flow to the 15-psig. system and increase the 200-psig. extraction flow.

If there is no concurrent increase in demand for 200-psig. steam, the pressure will rise above 200 psig. The 200/50 PRV, acting as a spillover valve, will then dump steam to the 50-psig. system. This excess steam in the 50-psig. system will cause the 7,000-hp. automatic extraction condensing turbine to reduce its extraction flow and increase exhaust flow as required to control pressure in the 50-psig. system and maintain the required horsepower output. The automatic action of the reducing valves and the turbine controls will continu-

ously adjust for swings in demand for process steam and shaft power.

A larger process steam load would increase the attractiveness of turbine drives. In fact, a 60,000-lb. per hour increase in 50-psig. steam load would decrease the fuel chargeable to power by about $75,000 per year.

Gas turbine and steam-turbine drive ... This is Alternate 3. Installation of a gas turbine instead of a steam turbine for the 7,000-hp. drive is shown in Fig. 14. Costs for this system are shown in Table 5. In addition to the shaft output, the gas-turbine exhaust (which still contains 17% oxygen) is used as preheated combustion air for the boiler. Steam for the 6,000-hp. automatic extraction condensing steam turbine is generated at 600 psig. in a supplementary fired exhaust-heat-recovery boiler. Extraction from the steam turbine supplies the 200-psig. system.

Noncondensing turbines, exhausting to the 50 and 15-psig. steam systems, also replace the 1,200 and 1,500-hp. motor drives.

In this alternate, steam flow through the pressure-reducing valves is more than 20,000 lb. per hour. With a more detailed system study, this steam could probably be utilized for miscellaneous small turbine drives to save the equivalent of another 500 hp. or more of purchased electric power. Care must be exercised to be sure adequate flexibility is maintained to handle swings in process steam use. If steam requirements were uniform enough that advantage of this one source of energy were recovered to produce horsepower, then payout on the additional investment for Alternate 3 vs. Alternate 2 would probably be reduced about 15%.

In addition, the gas-turbine exhaust has sufficient oxygen for a boiler having almost twice the steaming capacity required for this application. If more steam-generating capacity were required, the installation of the gas turbine would be more attractive.

TABLE 5—COSTS FOR GAS TURBINE AND STEAM-TURBINE DRIVE

Investment	
Transformers and load centers	$ 695,000
Switchgear and control	545,000
Motors and gears	740,000
Boilers	1,600,000
Steam turbines	455,000
Gas turbines	725,000
Cond. and cooling tower	225,000
Total	$4,985,000

Fuel and Power Costs	$/Hour	$/Year (8,000 hr.)
Fuel—270 M.M.B.t.u./hr. at 30 cents	81.00	$ 648,000
Electricity—12,150 kw.-hr. at 8 mills	97.20	780,000
Total		$1,428,000

Summary

Investment, operating costs, and payout are summarized in Table 6. Obviously, these systems provide different degrees of operating flexibility. But, for this analysis it is assumed that any of the three systems provides acceptable performance and reliability. The assumptions used in this summary are:

Depreciation	10%
Fixed charges	10%
Fuel	30 cents/M.M.B.t.u.
Purchased power	8 mills/kw.-hr.
Federal corporation tax	52%

Operating labor and maintenance expenses have not been included because there is such wide variation in the allocation of these costs.

Based on the requirements listed in Table 2 and these assumptions, alternates including a combination of motor and turbine drives provide payouts which are attractive for many applications.

Alternate 2 using steam turbines for the two larger drives reduces operating costs so that the added investment, compared to Alternate 1, is repaid in 4 years net. This is equivalent to 1.9 years gross before fixed charges, depreciation or federal corporation taxes. Alternate 3 has a net payout of 4.3 years (2.1 years gross) when compared with Alternate 1.

Alternate 3, utilizing a gas turbine and three steam turbines, shows a net payout of 5.35 years (2.6 years gross) for the additional $385,000 investment when compared to Alternate 2.

After the equipment has been fully depreciated for tax purposes, the annual savings after 52% federal taxes amounts to 18 to 20% of the initial added investment for either Alternate 2 or 3 when compared to Alternate 1.

Conclusions

The proper selection of the types of drivers for the major process equipment will have a marked influence on the over-all profits in a refinery or a petrochemical plant. Therefore, it is essential that the engineer have a thorough knowledge of the capabilities and operating characteristics of the drivers available so as to enable him to design a well-integrated, reliable, and economic drive system.

The drive system finally selected for a specific plant will depend upon many things, including fuel costs, power costs, and required return on investment.

This discussion demonstrates, by use of the steam and power system for a new refinery unit, how the savings in operating costs for one drive system are weighed against its increased initial investment. In actual practice new units are usually added to existing refineries or chemical plants. Whenever possible the new facilities should be integrated with the existing plant to produce the optimum in over-all plant economy. In these evaluations, do not overlook the significance of the continuing profits from savings in annual operating cost that usually extend well beyond the period required to pay out the added investment.

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TABLE 6—SUMMARY OF INVESTMENTS AND PAYOUTS FOR DIFFERENT DRIVER SYSTEMS

(Based on 30-cent/M.M.B.t.u. fuel, 8-mill power, and 8,000 hours per year)

	Alternate 1	Alternate 2	Alternate 3
1. Investment	$3,725,000	$4,600,000	$4,985,000
2. Fixed charges (10%)	372,500	460,000	498,500
3. Depreciation (10%)	372,500	460,000	498,500
4. Fuel cost	425,000	625,000	648,000
5. Purchased electric power	1,600,000	950,000	780,000
6. Total operating cost	$2,770,000	$2,495,000	$2,425,000
	Alt. 2 vs. 1	Alt. 3 vs. 2	Alt. 3 vs. 1
7. Savings in operating cost	$275,000	$ 70,000	$345,000
8. Net saving after 52% federal taxes	132,000	33,500	165,500
9. Difference in depreciation	87,500	38,500	126,000
10. Cash return (8 + 9)	219,500	72,000	291,500
11. Difference in investment	875,000	385,000	1,260,000
12. Net payout (years)	4.0 years	5.35 years	4.3 years

PROGRESS REPORT:

CO boiler pays off in big way

Utah Oil highly pleased with results at end of first year's operation

BY DONALD G. WARD
Utah Oil Refining Co.
Salt Lake City, Utah

A CAREFUL ANALYSIS of the results of the first year's operation of Utah Oil Refining Co.'s CO boiler shows:

1. Fuel-oil consumption has been about 55 to 60% of that needed for conventional boilers.

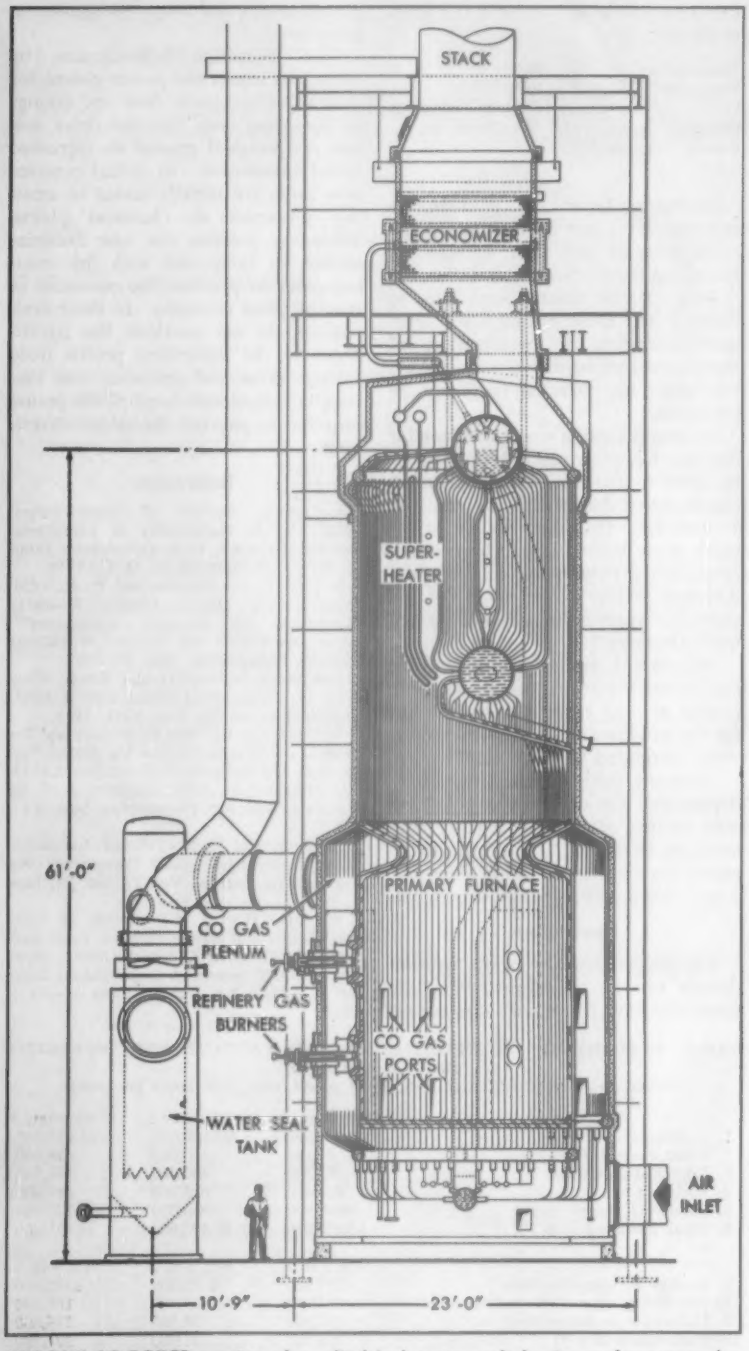
2. Incremental payout of the CO boiler over that of conventional equipment is about 2.2 years, after income taxes. Fuel-oil saving alone is enough to pay out the entire investment in 6.2 years, after taxes.

3. Maintenance costs are equal to or less than those for conventional equipment. Both water-side and fire-side tubes were clean after 12 months' operation.

4. The CO boiler is operated as part of the cat cracking unit, with no increase in personnel.

The unit, which has been in operation since May 1958, can generate 138,000 lb. per hour of steam at 300 psig. and 540° F. The boiler can operate on oil plus combustibles in the cat cracker regenerator flue gas, or on oil alone.

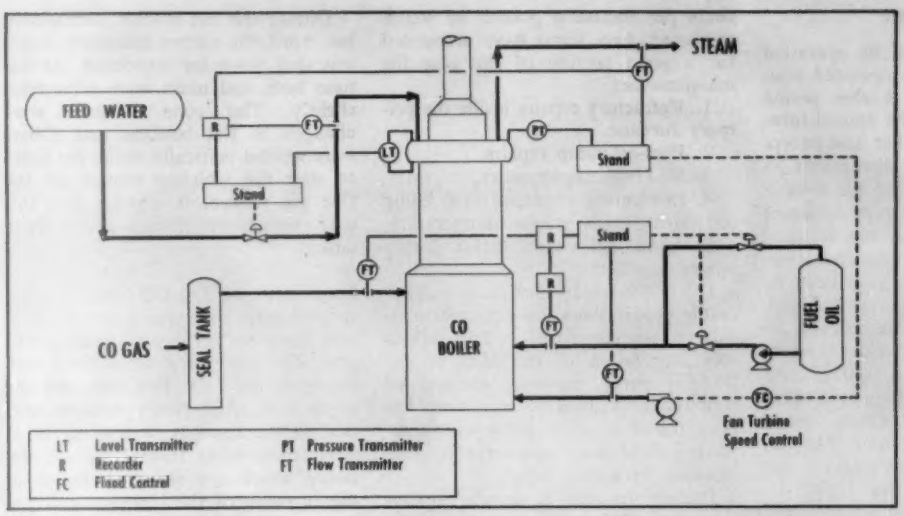
The CO boiler was installed to take care of additional steam requirements at the Salt Lake City refinery. Selection of this unit over conventional steam-generating equipment was made in order to utilize the combustibles in the regenerator flue gas from the 17,500-bbl. fluid unit, and to utilize existing manpower.



UTOCO'S CO BOILER consists of a cylindrical water-cooled primary furnace and a secondary furnace with steam-generating tubes. Fig. 1.

Boiler details . . . The boiler utilizes a cylindrical, water-cooled, primary furnace (Fig. 1). The secondary furnace contains the steam-generating tubes and a nondrainable-type superheater. At the outlet of the secondary furnace there is a convection-type economizer tube bank. Feed-water temperature is increased 130° F. as it flows downward through this economizer tube bank before entering the boiler.

Regenerator flue gas from the cat cracker precipitator is admitted first to the plenum chamber, then into the primary furnace through 12 rectangular-shaped ports. These ports are



COMPLETE combustion controls insure proper operation and proper proportioning of fuel oil and CO. Fig. 2.

cast into the furnace refractory tangentially to the furnace wall. This arrangement gives a swirling motion to the flue gas. Oil firing to assure a primary furnace temperature sufficient for complete burning of the carbon monoxide is provided by means of six register-type burners.

Three of these burners are spaced around the furnace approximately 3 ft. above the bottom group of flue-gas ports. The other three are spaced similarly but above the upper group of flue-gas ports. Each of these burners contains an oil atomizer and a gas pilot burner. The latter are lighted by spark-plug-type ignitors.

Seal tanks . . . Two seal tanks direct the regenerator flue gas either to the boiler or to the auxiliary stack. These seal tanks serve as valves in the flue-gas duct and permit operation of the cat cracker in case the CO boiler is down for repairs. A column of water equivalent in height to the pressure of the flue gas is used to make this seal.

Air for combustion is furnished by a top-discharge-type fan. The capacity of the fan is 185,000 lb. per hour of air at a pressure of 8-in. Hg. The drive for this fan is a 200-hp. turbine. The air discharges through an orifice, through a double-louver-type damper, thence into a chamber at the bottom of the primary furnace. From this chamber, the air enters the burner register through separate ducts to each burner.

Sealing air . . . Since the primary furnace operates at a pressure of approximately 11 in. of water, some provisions must be made to continuously seal the points where equipment such as oil atomizers, gas igniters, and soot blowers enter the furnace. A blower provides air at 20 psig. for the sealing air.

None of this equipment fits closely enough to the openings to prevent leakage of gas out of the furnace. Aspirating air is provided at these locations for use when this equipment has to be removed for repairs or cleaning. Aspirating air is also used at inspection ports. This aspirating air is obtained from the refinery air system at 50 psig.

Instrumentation

The boiler is equipped with **rather complete combustion controls.** Fig. 2 shows a simplified diagram of this part of the instrumentation.

The instruments operate to hold the steam flow from the boiler at a constant rate when set on automatic control. The fuel-oil system is equipped with two flow-control valves, one on the line going to the boiler and one on the line returning to the storage tank. Both of these flows are metered and a differential of these flows is recorded.

The relative positions of the two flow-control valves, is determined by a combined signal coming from the flue-gas flow, auxiliary air flow, and the differential of the two oil flows. Thus if the total flow of flue gas from the cat cracker regenerator should change, the net flow of fuel oil to the boiler would hold steam flow constant.

At the same time, the boiler pressure would drop slightly, which would automatically pick up on the air flow from the auxiliary air fan. Fine adjustments on air-fuel ratio are made on the basis of excess oxygen in boiler flue gas.

If there should be a change in the carbon monoxide content of the cat cracker regenerator flue gas there would be a change in steam flow. This would change total air flow automatically, which would in turn effect a change in the net flow of oil to the boiler, and thus hold the steam flow constant.

Feed-water control . . . Steam flow, water flow, and steam-drum level are all used to control the feed water to the boiler. This system includes a flowmeter on the water to the drum and a flowmeter on the steam leaving the drum. The signals from these meters are sent to a control valve in the feed-water line in such a manner as to effect a balance between these flows.

In order to compensate for the effect of swell inside the drum as pressure changes occur, a drum level instrument sends a signal to modify the combined signal from the two flows if necessary. Boiler-feed-pump speed is held constant by a centrifugal governor, while feed-water header pressure is held constant by means of an automatic recycle valve which recycles feed water back to storage.

Interlock systems . . . The instrumentation includes an interlock system to take over in case of certain failures. In the event of a drop in fuel-oil pressure sufficient to cause burner flame out, the interlock shuts a block valve on the oil line to the boiler. This will prevent an explosion if oil pressure is then suddenly restored with all atomizers wide open.

In the event of a failure of the auxiliary air flow, the interlock will close the oil block valve, close double dampers on the fan discharge duct, and open a steam valve to admit purge steam into the section of duct between the double dampers. The letter is to prevent escape of flue gas into the area.

Performance

The boiler has been in operation for 15 months. It has operated continuously except for a 3-week period in April 1959 during the annual turnaround at the cat cracker and except for three other short disruptions in service, two of which were due to fuel-oil pump failures. It is now apparent that the boiler has met the refinery need very well. Operating characteristics and performance have been as expected in most respects. Table 1 shows some typical operating data.

It will be observed that the temperature of the flue gas is 410° F. At the Utah catalytic cracking unit there is an electrical precipitator downstream from the regenerator. The design of this precipitator requires the gas to be cooled below the 1,000° F. temperature leaving the regenerator. This is accomplished by a waste-heat boiler plus some conditioning steam. Thus at Utah the regenerator flue gas reaches the CO boiler at a much lower temperature than is the case in many CO boiler installations. This results in more auxiliary fuel requirement and less savings from the CO boiler.

Flexibility . . . It was soon discovered that the boiler output could not be lowered below 110,000 lb. per hour and still burn all of the carbon monoxide contained in the regenerator flue gas entering the furnace. This is probably due to the low temperature (400°-425° F.) of the flue gas entering the furnace.

Actually this boiler has been operated with the combustion controls set on manual. This manual firing is guided by primary furnace temperature and by per cent oxygen in the flue gas leaving the furnace. As long as this boiler is used as a base-loaded unit, this will be the preferable way to operate.

Maintenance . . . Maintenance costs per thousand pounds of steam produced have been about the same as maintenance costs on the conventional-type boilers or approximately 2 cents per thousand pounds of steam produced. Five items have accounted for a good portion of the cost for maintenance:

1. Refractory repairs inside the primary furnace.
2. Fuel-oil-pump repairs.
3. Seal-tank repair work.
4. Instrument checking and lining out during early stages of operation.
5. Additional steam tracing during winter weather.

It has been necessary to do considerable repair work on refractory inside the primary furnace. This refractory has failed in the area of the flue-gas ports, exposing sections of wall tubes. A castable refractory has been found to do a good job of repairing these ports where the original castable refractory failed.

During the first 6 months' operation of the CO boiler both seal tanks developed leaks due to erosion by catalyst particles. This catalyst is carried in the flue gas from the cat cracker regenerator. The erosion occurred at the base of the cone near the bottom of the tank. Considerable patch welding had to be done to stop these leaks.

During the cat cracker turnaround last April, the carbon monoxide boiler was shut down for inspection. At this time both seal tanks were remodeled slightly. The cone bottoms were changed to flat bottoms and T-bars were welded vertically inside the tanks to stop the whirling motion of the flue gas stream. It appears that this will correct the erosion inside these tanks.

Inspection . . . The CO boiler was inspected after one year's operation. It was found to be in very good condition. The generating tubes were very clean on both the fire side and the water side. Apparently catalyst carried in the flue-gas stream serves to scour these tubes free of the ash deposits which are so often found in the furnaces of the conventional-type units at the main refinery steam plant. No turbining of the tubes on the water side was necessary. All drum internals were clean.

The relatively low heat-release rate of the CO boiler as compared to that in the conventional-type boilers seems to contribute to this water-side cleanliness.

TABLE 1—TYPICAL PERFORMANCE DATA

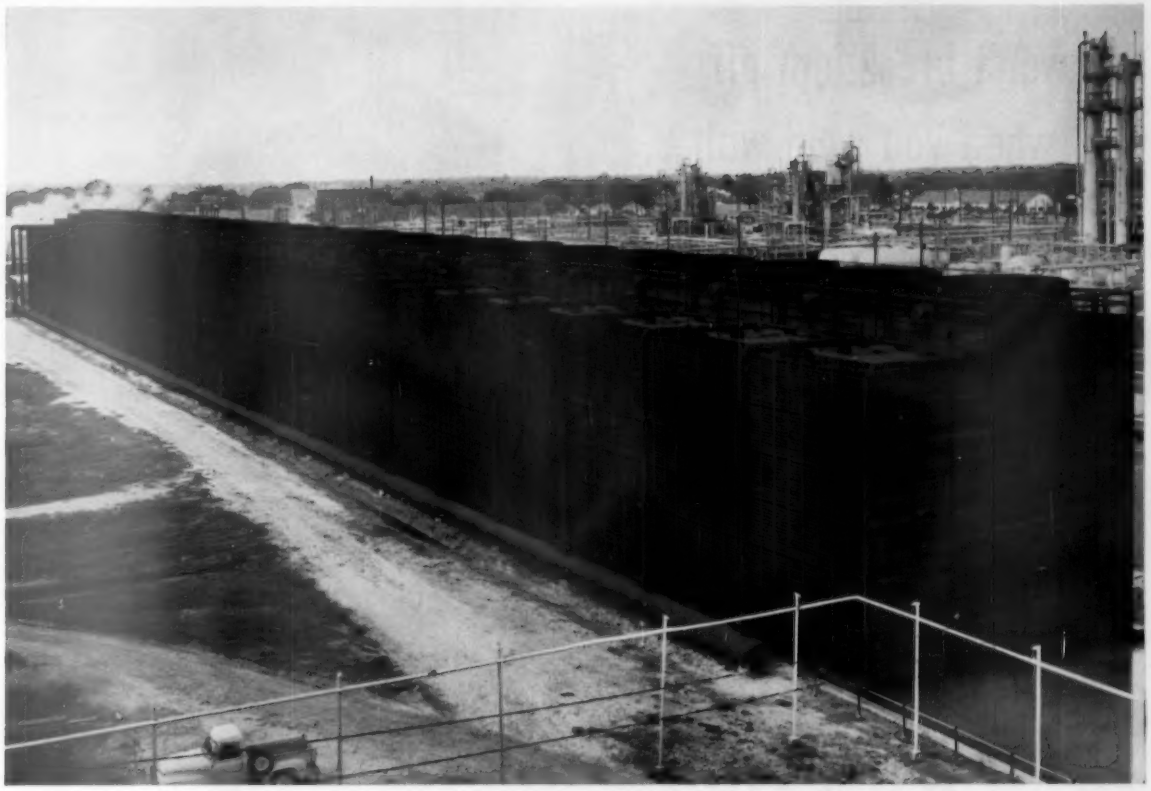
Steam Flow, M lb./hr.	120
Flue gas flow from FCCU regenerator (wet basis), M lb./hr.	189
CO in flue gas, Wt. %	6.5
Temperature of flue gas to boiler, ° F.	410
Heat from supplementary fuel, M.M. B.t.u./hr.	102.1
Heat from Regenerator Flue gas, M.M. B.t.u./hr.	71.4
Temperature in primary furnace, ° F.	1,560
Temperature in secondary furnace, ° F.	1,380

Lion Oil completes new petrochem facilities

PROPYLENE TETRAMER facilities have been completed, and first shipment of this material was made in early November by Lion Oil Division of Monsanto Chemical Co. from the company's El Dorado, Ark., refinery.

The new product is shipped in 10,000-gal. tank cars to a Monsanto Inorganic Division plant at Monsanto, Ill., where it will be utilized as an intermediate in the manufacture of a number of synthetic detergents.

The propylene tetramer unit is a part of a multimillion-dollar modernization program started at the refinery in 1957. Other units include a 5,000-bbl. catalytic reformer, a 5,000-bbl. hydrosulfurization unit for making high-quality diesel fuels and burner oils, and a 5,000-bbl. solvent deasphalting unit for increasing yields of paving-grade asphalt and gasoline.



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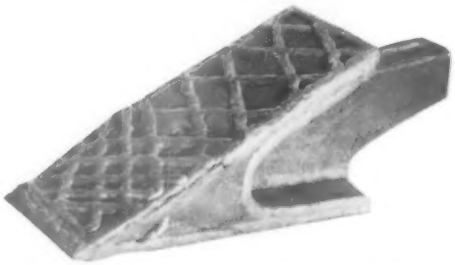
Elongation in 2"	55%	37.5%

Hardness—Single pass on manganese steel; as deposited—15 Rc; as work-hardened—48 Rc.
Two passes on manganese steel; as deposited—18 Rc; as work-hardened—48 Rc.



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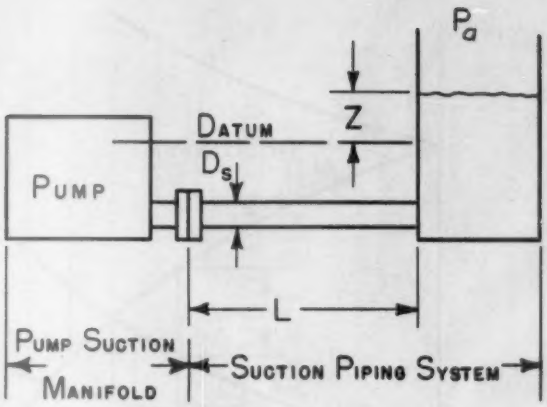
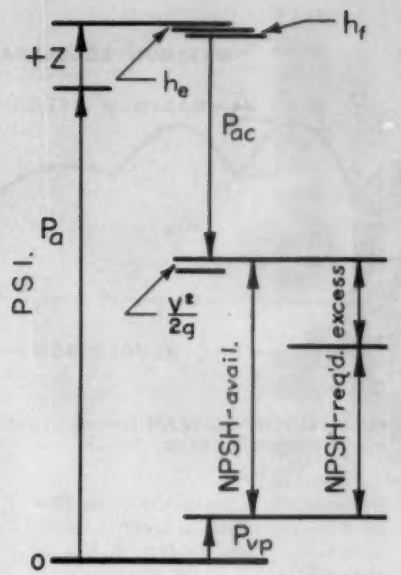


PHYSICAL CHARACTERISTICS of a mud-pump suction system. Fig. 1.



PRESSURE DIAGRAM for suction system of Fig. 1 shows pressures and heads to scale. Fig. 2.

Here's a simplified approach to

Solving mud-pump problems

- Standards are developed for the analysis of the characteristics of mud-pump suction and suction piping. Proper application of these standards should reduce pumping troubles and costs and permit greater pump output.

BY WALTER E. LILJESTRAND
Chief Engineer,
Mission Manufacturing Co.

MAKERS and users of centrifugal pumps have the benefit of standards and generally approved formulas for designing or analyzing suction systems.

Heretofore, there have been no such standards and formulas for reciprocating mud pumps.

This paper analyzes the characteristics of mud-pump suction and suction piping, not only in areas where the manufacturers are responsible but also in the areas where users are responsible.

This material should be a good basis for preparing standards on oilfield pump-suction systems. It will reduce pumping troubles and costs and permit greater pump output.

A good understanding of mud-pump suction problems can give the following advantages:

1. Less replacement of fluid and parts.
2. Longer life of power end drive systems.
3. Increased pump capacity.
4. More dependability of pump under adverse conditions.
5. Possibly less costly suction piping system.
6. Less concern and worry by the crew.
7. Effective use of suction dampeners and prechargers.

This article is adapted from a paper titled, "Simplified Approach to Understanding the Suction Problems for Reciprocating Mud Pumps," presented at ASME's 1959 Petroleum Mechanical Conference, Houston.

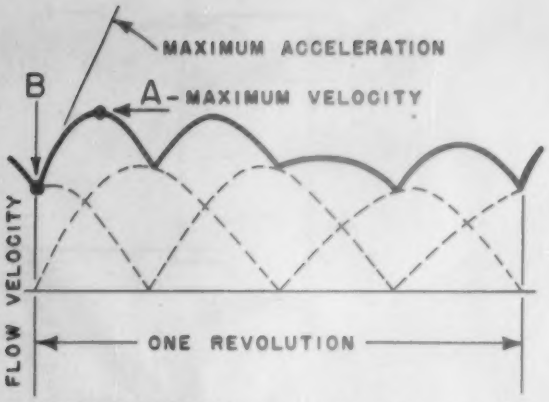
Centrifugal - pump approach. The chemical industry has taken advantage of studies and testing of suction systems of centrifugal pumps. Manufacturers supply accurate data on centrifugal - pump suctions using water. With these data users can design suction systems so that pump performance is good even when the suction systems are built at minimum height and therefore at lowest cost.

Cavitation problems are few; in case one occurs, simple direct corrections are easily made.

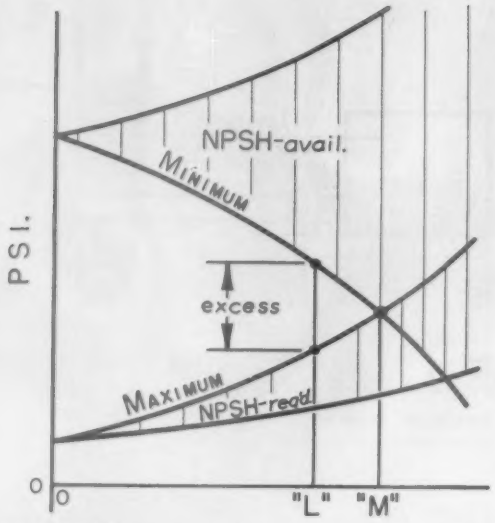
Flow through the suction system of a centrifugal pump is steady for a normal condition so that conditions are easily measured, and requirements for a different installation are easily specified. Performance in the field duplicates test-stand performance.

Reciprocating approach. Flow is cyclic in the suction of a reciprocating pump because flow follows the start-and-stop motion of the pistons. With each pump revolution, the flow pattern is repeated. The pattern depends upon the number of cylinders, single or double-acting, piston-rod area, connecting-rod crank-length ratio, and relative angular positions of cranks. Flow rate at any instant in the pattern or revolution also depends upon piston area, piston-stroke length, and pump-crankshaft speed.

This cyclic flow pattern makes analysis of the conditions in suction more complex than for centrifugal pumps.



FLOW-VELOCITY DIAGRAM for typical suction system of duplex double-acting pump. Fig. 3.



NPSH VALUES change with changing pump speed. Width of NPSH region at given speed represents maximum cyclic effect of acceleration and deceleration. Fig. 4.

However, the effect of the cyclic flow must be understood in order to design a suction system. In fact, it will be shown later that in the suction piping systems for conventional mud-pump installations (not reciprocating pumps in general), dimensions are such that the cyclic flow pattern effect is dominant and is a factor indirectly limiting the capacity of the pump. It controls to such a degree that understanding and control of it will solve most of the problems for mud pumps.

The suction system. The complete suction system of a mud pump, Fig. 1, will be referred to in two parts, divided at the suction flange. The part from the suction flange to the faces of the pistons and to the discharge valve decks will be called the **pump-suction manifold.** The part from the suction flange to the free mud surface will be called the **suction piping system.** The object of the complete suction system is to fill the pump cylinders with fluid.

Pump-suction manifold. Failure to fill the pump at the same rate that the piston strokes causes "fluid knocking." This is detrimental to pump parts and limits pump capacity. Fluid knocking is a loud sound in the pump caused when the fluid catches up with the piston after lagging behind at the beginning of the suction stroke.[1,2]

A characteristic of the pump-suction manifold is that it requires a small absolute total pressure or head to:

1. Provide the velocity of flow in the pump-suction manifold.
2. Overcome friction loss in the pump-suction manifold.
3. Operate the suction valves.
4. Provide when needed the acceleration of mud in the pump-suction manifold.
5. Overcome vapor pressure of the mud.

Friction and velocity head increase with flow rate.

Acceleration of mud increases with pump speed and piston diameter. This acceleration of mud or pressure needed for acceleration head has four high values on each pump revolution of a duplex, double-acting pump. Acceleration head is greatest when the leading head-end piston is just starting its stroke; it is less for other strokes because of the effect of piston-rod area, connecting-rod effect, and flow pattern in the manifold. Only the greatest head is of interest since it is the first one to cause fluid knocking.

Let us introduce the term "net positive suction pressure required," or the NPSH required. This is the absolute pressure of the fluid at the suction flange (corrected to datum) that is just sufficient to overcome: (1) fluid loss in the pump-suction manifold; (2) valve-opening loss; (3) velocity-head increase; and (4) the highest acceleration head in the cycle after subtracting absolute vapor pressure.

To prevent fluid knocking, or to insure filling the pump at the same rate the piston strokes, the suction piping system external to the pump suction flange must always supply fluid at a pressure equal to or greater than the NPSH required.

Suction piping system. Now, let us examine the "net positive suction head available" or NPSH available. This is the total pressure of mud (absolute pressure corrected to datum plane plus the velocity head) at the pump-suction flange less the absolute vapor pressure of the mud. It consists of head values such as atmospheric pressure, height of free surface above or below datum plane, and the specific-gravity effect less losses such as entrance loss, friction loss, acceleration head, and absolute vapor pressure. In symbols this is expressed as:

$$\text{NPSH available} = P_a \pm \frac{\text{sp. gr.}}{2.31} Z - \frac{\text{sp. gr.}}{2.31} (h_e + h_f) - P_{ac} - P_{vp} \quad (1)$$

The fluid-head values in Equation 1 are all a part of the suction piping system. They are dependent on the:

1. Rate of mud flow.
2. Rate of change of mud flow (acceleration).
3. Physical size and condition of the suction piping system.

These values can be calculated or measured. On a conventional suction system for the average mud pump, the values of pressures and losses shown in Fig. 2 are approximately correct. The atmospheric pressure P_a and the static head Z are easily determined so the only other major portions to determine are acceleration head P_{ac} and vapor pressure P_{vp}. In this respect the suction problem for mud pumps is greatly simplified because acceleration head is dependent on the physical size of the suction piping system. The acceleration head P_{ac} can be calculated.[2]

Cyclic flow. There is a simultaneous need for acceleration of mud in the pump-suction manifold and the suction piping system during the start of a given piston stroke. In a duplex double-acting pump there are four accelerations each revolution. These

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"The NPSH required by the pump at zero speed is that required to open a suction valve"

are shown in the mud-flow-velocity diagram, Fig. 3.

Effect of the acceleration in the pump-suction manifold is to increase the NPSH required because this acceleration is an included factor. In contrast the effect of the acceleration in the suction piping system P_{ae} is to decrease the NPSH available because this acceleration is an excluded factor.

Value of NPSH available can be determined for any point on the revolution shown in Fig. 3. At point A, the highest velocity, the entrance loss h_e and friction loss h_f are maximum but still very small. Acceleration head P_{ae} is zero. NPSH available will therefore be a large value at point A.

At point B, on the other hand, entrance loss h_e and friction loss h_f are somewhat reduced and still very small, but the acceleration head P_{ae} is large and at its maximum. The NPSH available will be minimum at point B for the revolution.

Fig. 2 is an illustration of conditions at point B in Fig. 3. Here the slope of the velocity curve shows maximum mud acceleration.

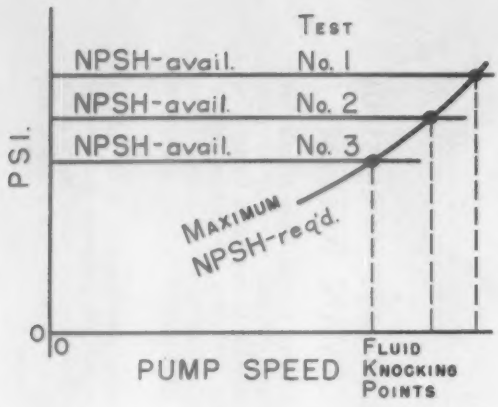
The scale values shown in Figs. 2 and 3 depend on speed of the pump. Fig. 4 illustrates the character of NPSH available and NPSH required vs. speed of pump.

The NPSH available at zero will be:

$$\text{NPSH available} = P_a \pm \frac{\text{sp. gr.}}{2.31} Z - P_{vp} \qquad (2)$$

The NPSH available is represented in Fig. 4 as a band or region. At a given pump speed the width of the band is produced by alternate accelerations and decelerations of the mud. The deceleration just preceding point B of Fig. 3 is represented by the expression P_{de}. This is found experimentally to be equal to or greater than the acceleration P_{ae} following point B.

Pressures caused by deceleration are of no direct value for fluid-knock prevention because they do not last long and are gone before the following acceleration takes place. The term P_{de} was purposely omitted from Equation 1. The minimum values of NPSH available obtained at time of maximum acceleration are of chief concern.



NPSH REQUIRED was determined by successive laboratory pump-suction tests. Fig. 5.

The NPSH required by the pump at zero speed is that required to open a suction valve.

Band width of the NPSH required for pump speeds is caused by the cycle of the pump. The maximum value for any particular speed occurs the same instant in the revolution that the minimum NPSH available occurs.

The difference between them or "excess" of NPSH available over NPSH required is the reserve available to take care of unexpected adverse changes. Such changes may be increased vapor pressure, partially clogged line, loss of head of mud, etc.

Maximum speed M that the pump can run without fluid knocking is found at the intersection of the NPSH-available minimum line with the NPSH - required maximum line. These two lines of course represent the conditions for the leading head-end cylinder. The acceleration head peaks for the other cylinders are smaller so the pump speed at which fluid knocking begins in them will be a little higher. This is one of the reasons fluid knocking is very irregular when it first occurs as pump speed increases.

Plunger pumps with symmetrical suction - velocity diagrams will also show fluid-knocking irregularities with speed increases.

Position of the maximum NPSH required curve in Fig. 4 for a given pump and piston diameter is rather fixed. Its position and shape do not depend on suction piping-system conditions.

Position and shape of the minimum NPSH-available curve are, however, dependent on dimensions and suction conditions of the suction piping system. This provides the possibility of collecting field test data over a period of time to plot the NPSH required for the pump.

Each time there is a new operating condition such as a change of static head, mud weight, mud temperature, or pipe dimensions, a test should be run by raising the pump speed until fluid knocking develops. This is the speed at which the two curves cross in Fig. 4. Values of NPSH available can be computed if the suction piping system is normal, that is, no clogged or leaking air. Each change in conditions moves the NPSH - available minimum curve and provides a new crossing point. A series of such points determine the NPSH-required curve.

Each computed or measured value used in Equation 1 to obtain NPSH available and to determine the NPSH required will have a tolerance or probable error. These unknowns should not be overlooked but it is suggested that the allowance made on each determined value be as small as possible so that the excess of NPSH available over NPSH required be as large as possible. This will give a clearer picture of how much allowance is available for unknowns and the unexpected.

To determine NPSH required. There is no way to calculate the NPSH required for centrifugal pumps, so their manufacturers have worked out very accurate testing methods. It may be possible to write equations for NPSH required for piston pumps after sufficient experimental background has been obtained. Manufacturers of piston pumps can also measure NPSH required quite accurately. Fig. 4 shows that NPSH required is equal to NPSH available at the speed where the pump just begins to knock.

NPSH available can be very ac-

curately determined at this speed on a special test stand designed so that all the difficult-to-measure terms of Equation 1 are zero. The terms of h_e, h_f, and P_{ac} will be zero for the suction piping system if the pipe length is zero. In other words the mud tank should be connected to the pump with a short well-rounded nozzle. The tank must be closed and capable of sustaining full vacuum. The surface of the mud should be only a few feet above the datum plane of the pump and kept constant by returning the pump discharge to it. Also the mud should be deaerated.

Control of the air pressure over the mud will give successive test points for various pump speeds as shown in Fig. 5.

At knocking:

$$\text{NPSH required} = \text{NPSH available.}$$

$$\text{NPSH available} = P_a - P_{sg} - P_{vp} \pm \frac{\text{sp. gr.}}{2.31} Z \qquad (3)$$

Such data should be obtained on each pump style and size for various speeds and piston sizes. Water should be the first fluid tested but it should be followed by muds of various types and weights.

Electronic suction gage readings will faithfully reproduce the cycles but will be difficult to interpret. It may eventually be possible to use these data to determine NPSH values.

Work to be done. Thus far, we have presented the general nature of the suction problem and relation of its components. If the user is to obtain the benefits of a correctly designed system, there must be further work on this approach to refine it and to agree on details of symbols, terms, computations, tables, curves, etc.

We must obtain more data for correct evaluation of terms. For example, vapor pressure of various muds should be checked to see if water vapor pressures are sufficiently correct as substitutes. This may be quite important for the higher mud temperatures and different mud types and weights. If water vapor pressures give conservative results by being substantially higher than mud vapor pressures, the suction piping systems may be expensively overdesigned.

Acceleration head of the suction piping system being a dominant term, agreement should be reached on a correct expression for computing it. If possible, the results should be shown in curves or tables to simplify using it in design work. It might even be possible within a given company to work out standard suction piping systems.

NPSH can be expressed in either feet of water (as in centrifugal pumps) or in psia. Psia. may be the best for oil-field work considering that mud is a normal fluid and is not of standard weight.

We placed no emphasis in this paper on the importance of a standard reference plane or datum plane for static head Z and for correcting pressure-gage measurements. Curves and charts could be quite confusing without agreement on the location of this datum plane in the pump. Locations might be the piston-rod centerline, the top of the discharge valve deck, or the centerline of the suction flange. The height of the plane above the feet of the pump is an indirect factor affecting the static head Z.

What can be done now. Several steps can be taken to obtain full benefit of suction piping systems designed to eliminate or control fluid knocking. The first step can be taken immediately.

1. Using the formula for acceleration head, design systems for minimum acceleration. In general the shortest, straightest, and largest suction pipe will produce the largest NPSH available. The "excess" over NPSH required will not be known but can be large enough to take care of most unexpected changes.

2. Determine the NPSH required on pumps by field testing at knocking speeds. This burdens the pump with all the short cuts of this approach but it will then be possible to match a suction system to a pump.

3. Determine the NPSH required by laboratory tests to give pump all the credit it is due.

4. Refine equations for calculating NPSH available in light of experience with laboratory tests to make field test data agree.

Some arrangements of piping systems may require suction pulsation dampeners to reduce the acceleration head and increase the NPSH available. In some instances where suction pipes must be long, or lift high, or gas is entrained in the mud, a precharging centrifugal pump when properly selected and installed produces very beneficial results. Poor results on precharging in the past can be attributed to a lack of understanding of the problem.

Until more experience develops, there should be left a definite excess of NPSH available over NPSH required to take care of tolerances and unexpected changes.

Acknowledgments. The author is indebted to S. L. Collier who conducted many of the pump tests and analyses and to Dr. Allen F. Sherzer of University of Michigan who was a consultant on centrifugal-pump NPSH studies. The Hydraulic Institute Standards were a valuable background source for terms and definitions.

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NOMENCLATURE

NPSH required = net positive suction head required in psia.
NPSH available = net positive suction head available in psia.
P_a = atmospheric pressure in psia.
Z = elevation of free surface of mud above datum elevation in feet (or –Z if below datum).
h_e = head lost at entrance of suction piping system in feet of mud.
h_f = head lost in friction in suction piping system from the entrance to the pump-suction flange in feet of mud.
P_{ac} = acceleration head used during increase of mud-flow velocity in suction piping system in psia.
P_{dc} = deceleration head produced during decrease of mud-flow velocity in suction piping system in psia.
P_{vp} = vapor pressure in psia.
sp. gr. = specific gravity of fluid or mud weight in pounds per gallon/8.33.
g = acceleration due to gravity 32.17 ft. per second per second.
V = velocity in the suction averaged for the cross-section of the pipe-flow area determined at the point of the gage connection using the instantaneous flow divided by the pipe-flow area, in feet per second.
$V^2/2g$ = velocity head in feet of mud.
P_{sg} = reading of a suction gage in psig with P_a as datum.

CAREFUL LANDSCAPING at Esso's new installation in Wales will hide almost all of the plant and tanks in a natural ravine. The 300-ft. concrete smokestack will be part of a pipe-still furnace, the largest of its kind in the world. Under way since June 1958, the pace is quickening as . . .

Welsh refinery passes halfway mark

CONSTRUCTION on Esso Standard Oil Co.'s 100,000-bbl. per day refinery at Milford Haven, Wales, is moving at a brisk pace. After 15 months' work, the project is more than 50% complete. The plant is slated to go on stream near the end of 1960.

Flow plan of the plant is similar to the one at Whitegate, Eire, (OGJ, Aug. 24, p. 74) which was formally dedicated earlier this year. Like it, the new refinery will produce fuels only. Plans are to make propane, butane, gasolines, turbojet fuels, diesel oil, gas oil, and heavy fuel oil.

The Milford Haven plant will serve Wales and some of the western parts of England and Scotland. The project will cost an estimated $50.4 million.

A unique feature of the plant will be the attempt to blend it with the natural surroundings. Esso has taken great pains to insure that the layout is adapted to the terrain, which lies on the fringe of a scenic national park. As much of the plant as possible will be hidden in a natural ravine, but those units which must be exposed will be painted to blend with the surroundings. Detailed plans for tree belts, gardens, and color schemes for tanks and other equipment have been worked out by planning authorities.

Marine conditions at this location are excellent. The harbor is sheltered and a water depth of 48 to 60 ft. can float big tankers even at low tide. A 3,500-ft. T-shaped terminal can handle two 100,000-dw. ton tankers at once at its outside berths. Inside berths will accommodate ships up to 5,000 dw. tons.

Pollution problems will be handled in an interesting way. Storage tanks are located on two small hills. Between these two hills is a natural ravine which will provide a place for drainage and spillage should a tank or a pipeline burst. In addition, all process water and refinery waste will be directed to this "skimming pond" before it is treated and returned to the sea. The ravine will hold 5 million gallons under ordinary circumstances and nearly twice as much in an emergency.

Processing . . . Process units will include a pipe-still furnace, atmospheric topping tower and distillation train, a Hydrofiner, Powerformer, $CuCl_2$ sweetener, and a naphtha-splitting unit.

The pipe-still furnace will be the largest of its kind in the world, having a 465-M.M. B.t.u. capacity per hour.

Since fuel oil is the primary European demand, the plant will have no cat cracker, but a Powerformer will serve to upgrade straightrun gasolines.

Hydrogen from this unit will go to the Hydrofiner where it will remove sulfur as H_2S. The Hydrofiner will employ a fixed-bed catlyst for the purification of naphthas, diesel, and gas-oil fractions. Light naphtha and turbojet fuel will be sweetened with $CuCl_2$.

Process steam will be supplied at 150 psig. and 450° F. from two 130,000-lb. per hour boilers.

Air-fin coolers are being installed to reduce corrosion and water-pollution problems to a minimum.

A multiple-jet ground flare, designed by Esso's research department, will be used instead of the conventional stack flare. The flare is reported to be smokeless, noiseless, and nonluminous.

All processing will be controlled from one room provided with a graphic panel.

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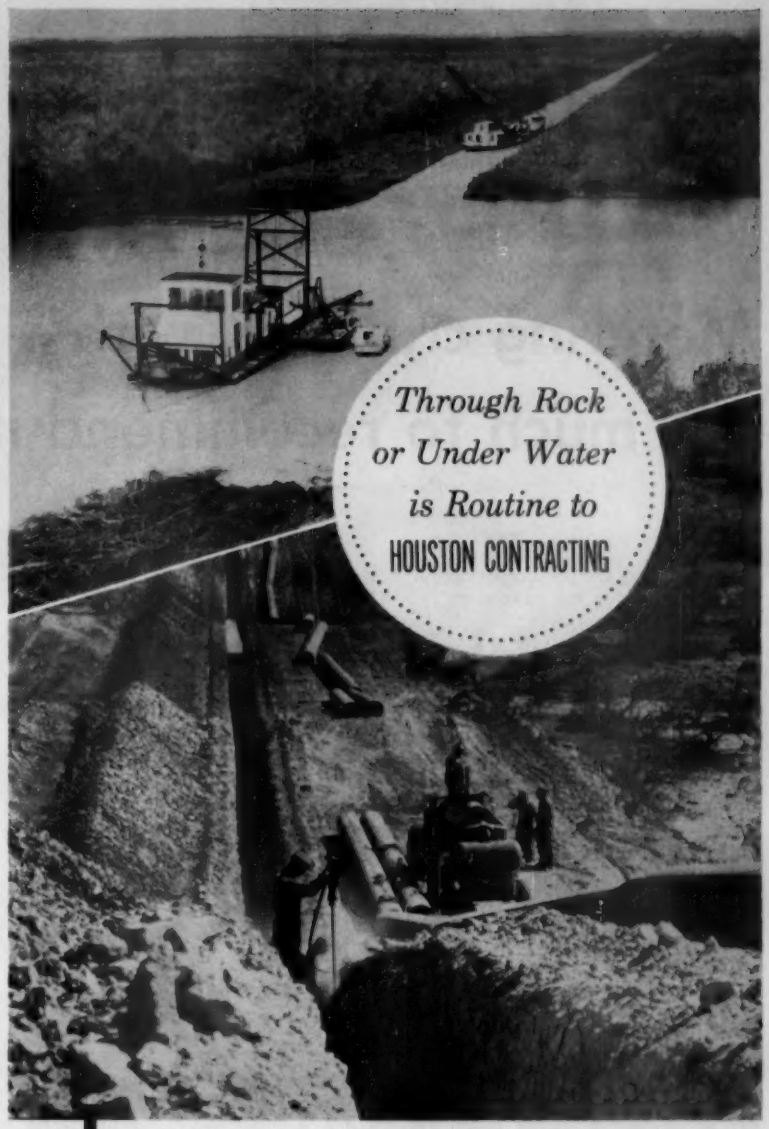

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103

Because a turbine will pass dirt without damage, because it is the least-complicated mechanical meter, has good running balance, low head loss, and can be housed inside the normal pipeline . . .

Metering crude oil with a turbine has much to recommend it

BY HENNING KARLBY
Director
and
WINSTON F. Z. LEE
Chief Reserach Analyst, Central Research and Development Laboratory, Rockwell Manufacturing Co., Pittsburgh, Pa.

METERING CRUDE OIL with a turbine has so far not been generally accepted, because the calibration factor (or "meter factor") changes too much with both flow rate and viscosity of crude oil.

We propose to show the reason for this change, and its cure, as verified by tests on a compensated metering turbine which can be calibrated once for all, without needing—for calibration purposes—the actual liquid to be encountered in service.

The Calibration Factor

The calibration factor of any mechanical fluid meter is "turns per volume passed," in this case, "turns per barrel," but that is numerically equal to the ratio of turbine angular velocity to flow rate, (ω/Q).

We shall confine the discussion to axial-flow metering turbines, which have the lowest head loss of any type, and we shall speak of a turbine speed (u) at a mean effective radius (r),

Paper presented at ASME Petroleum Mechanical Engineering Conference, Houston, Sept. 20-23, 1959.

so when we define a mean flow velocity (v) as the flow rate (Q) divided by the annular area (A) in which the turbine blades turn, the calibration factor becomes turbine speed divided by mean flow velocity (u/v).

Fig. 1 then shows the kinematics we are dealing with: Setting the turbine blading at some definite angle (α) would make the turbine speed a definite ratio of flow velocity ($u = v \tan \alpha = Kv$) if there were no forces resisting rotation. Of course there are, so the real turbine slips and the calibration factor becomes

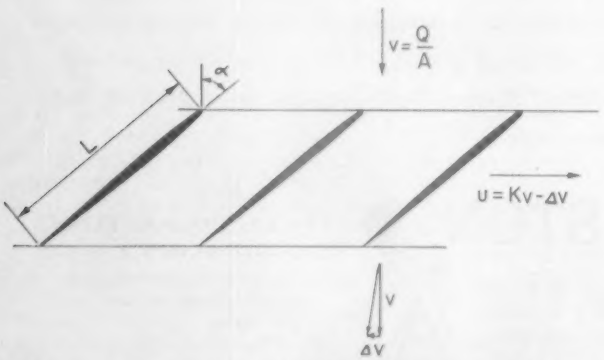
$$\frac{\text{(Ideal turbine speed)} - \text{(slip velocity)}}{\text{(flow velocity)}} = \frac{Kv - \Delta v}{v} \qquad (1)$$

The design requirement is clear. The slip ratio must be made constant, within the tolerances and flow rates imposed, regardless of resisting forces. We must try to make the slip constant, the slip being slip velocity divided by flow velocity or $\Delta v/v \approx$ const, in order to make the calibration factor nearly constant, regardless of flow conditions.

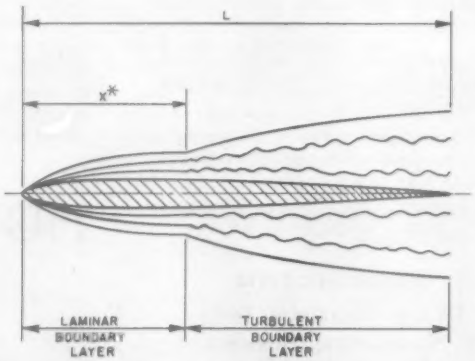
Slip as a Function of Reynolds Number

Before going on, we must state our limited aim, which is to present a physical picture of what controls the slip and to justify this picture by comparison with tests.

Therefore, we are forced to simplify the matter grossly. We cannot show in detail how to design a good metering turbine—that subject is covered in a separate paper.[1] We shall, accordingly, present nothing but physical facts and their logical consequences.



FLOW is shown through turbine blading at mean radius. Fig. 1.



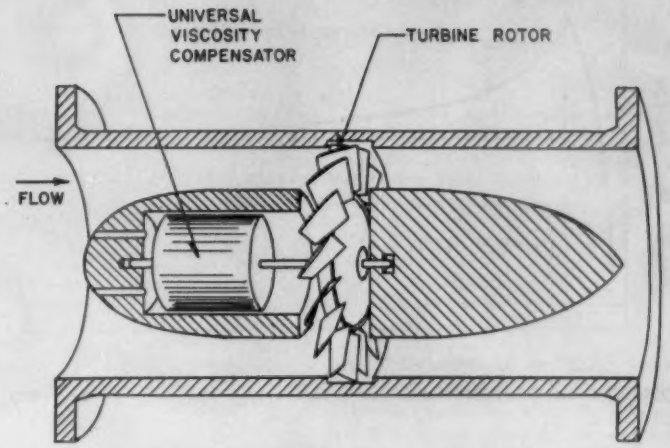
BOUNDARY LAYER of a turbine blade in transition region. Fig. 2.

It is of course now commonplace to consider pressure loss in a pipe as a function of Reynolds number (or the ratio of acceleration work to friction work). Any other presentation leads to an incoherent mass of empirical data.

It is perhaps not commonplace to realize that the same holds true for the calibration factor (or the slip) of a well-designed metering turbine. Accepted trade practice, we believe, is to calibrate a fluid meter in a given fluid at specified flow rates and temperatures, and to expect this calibration to be different for other fluids at other rates and temperatures.

In terms of Reynolds numbers, which of course must be referred to meter dimensions and the flow velocity just defined, the matter is, however, much simpler. A well-designed metering turbine has a single "universal" calibration curve, regardless of nature and temperature of fluid, and this universal calibration curve shows clearly how the calibration factor can be made nearly constant.

The first conditions for this to be true are the following: Mechanical friction must be small enough to cause negligible slip in the metering range. The meter must be so designed that the predominant force causing slip is that due to skin-friction drag. That this can be attained will be shown by the agreement between theory and tests. We shall now proceed to derive slip ($\Delta v/v$) as a function of blade-chord Reynolds number.



"COMPENSATED" metering turbine diagram. Fig. 4.

Driving Force on the Turbine

Referring again to Fig. 1, we have the turbine blading unrolled at some mean effective radius (r). Crude oil (or for that matter, any liquid) metered at low head loss remains essentially of constant density across the blading, so the axial component of the flow velocity (v) remains unchanged, but a tangential component (Δv) is added as the result of overcoming forces resisting rotation. The Reynolds number to be used is then

$$\frac{\text{(Blade chord length) (velocity past the blades)}}{\text{kinematic viscosity}} = R$$

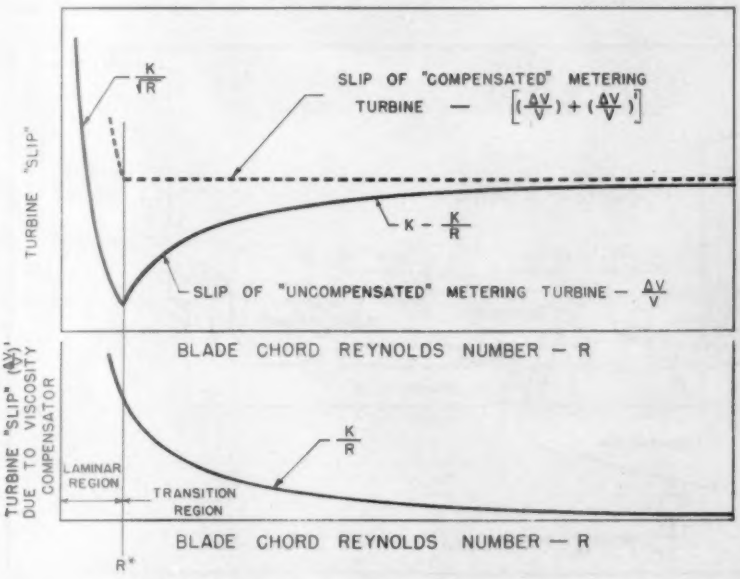
The blades of course must be close enough together to insure that the liquid leaves parallel to the blades without having them so close that excessive head loss is caused. We shall now consider the state of steady rotation where the dynamic forces are in equilibrium, ignoring all secondary effects. Newton's second law (or the definition of force as the time rate of change of momentum) then takes the simple form

Driving force on blading
= (mass rate) (slip speed)

which we expand into its more familiar form

$$F = K\rho v \Delta v \qquad (2)$$

where (ρ) is the mass density of the liquid, and we shall now consider:



TURBINE "SLIP" as a function of Reynolds number. Fig. 3.

Laminar-Flow Operation

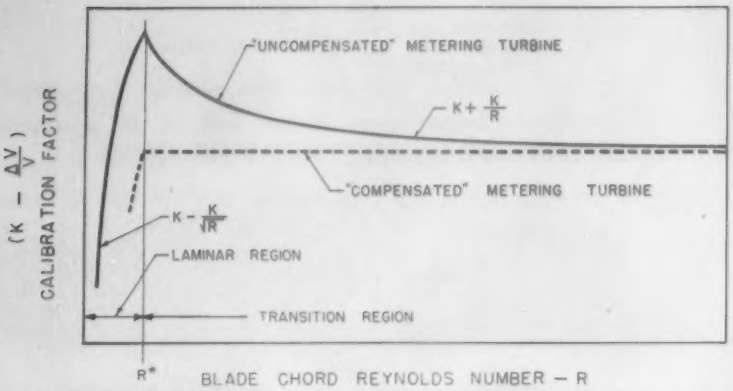
Depending upon upstream disturbances, meter design, and so on, there is a fixed critical Reynolds number (R^*) below which the flow over the entire blade length (L) is laminar. Consequently, the entire blade boundary layer is laminar. The dynamic equilibrium is then

$$K\rho v \Delta v = K\rho v^2 L \quad f(R) \qquad (3)$$

where f(R), or more commonly, the drag coefficient of the blading, obeys the well-known Blasius relation

$$f(R) = K/R^{1/2} \qquad (4)$$

Allow us from now on, in the interest of simplicity, to use (K) indiscriminately for any constant, of course not necessarily the same. Furthermore, to indicate our gross simplifications, we shall use ~ (approximately equal to) instead of = (equal to). Substituting Equation 4 in Equation 3



THEORETICAL CALIBRATION factor as a function of Reynolds number. Fig. 5.

$$K\rho v\Delta v \sim K\rho v^2 L/R^{1.2} \quad (5)$$

or the slip in the laminar region is

$$\Delta v/v \sim K/R^{1.2} \ (R<R^*) \quad (6)$$

which is certainly not constant, or we must reject the simple turbine as a meter in the laminar-flow range. Compound metering turbines should, however, be able to handle laminar flow. We have such meters under development, but this is beyond our present subject.

Turbulent-Flow Operation

Going to the other extreme, at very high Reynolds numbers (meaning high velocities or very "thin" liquids, e.g., gasoline) the matter is relatively simple, so it is in this region metering turbines so far have been accepted as superior to any other mechanical meters. Briefly, if the Reynolds number is sufficiently high, the blade-drag coefficient f(R) approaches a constant asymptotically, or "full hydraulic roughness" is attained and the force balance is

$$K\rho v\Delta v \sim K\rho v^2 L \quad (7)$$

or

$$\Delta v/v \sim \text{const} \quad (8)$$

This fact has already been demonstrated by the successful performance of existing turbines metering; e.g., gasoline.

Transition-Flow Operation

Unfortunately, the practical range of flows of crude oils is not confined to the high Reynolds numbers mentioned. It actually covers the entire range from laminar flow up. Metering crude oil with a turbine then means holding the slip ($\Delta v/v$) nearly constant in the so-called transition range, which in our case is covered by the well-known Prandtl-Schlichting skin-friction formula for a flat plate at zero incidence.

Instead of just flatly stating this formula, we believe it would be interesting to show the physical picture it reflects, which is very simple. At the critical Reynolds number (R^*) defined previously, the entire blade boundary layer is by definition laminar. At any higher value of R the tail end of the boundary layer will become turbulent and the turbulence will creep forward as the Reynolds number increases, again governed by the Reynolds number to that

$$R^* = Kvx^*/\nu = K \quad (9)$$

where (ν) of course is the kinematic viscosity of the liquid, or the critical length (x^*) of the portion of the boundary layer still laminar is

$$x^* = R^*\nu/Kv = K/R \quad (R>R^*) \quad (10)$$

as illustrated in Fig. 2.

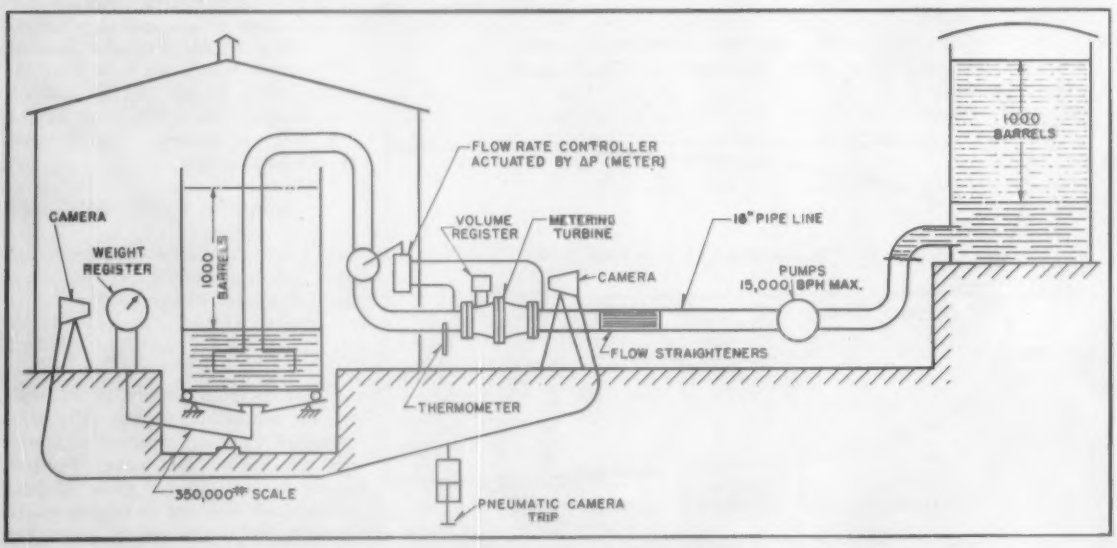
Following Prandtl and Schlichting, the drag coefficient of the blading in the transition range is then the sum of the laminar-skin friction drag over the length x^* and the turbulent skin-friction drag over the remaining length ($L-x^*$) and we can write the condition of dynamic-force equilibrium

$$K\rho v\Delta v = K\rho v^2(L-x^*) + K\rho v^2\, x^*/R^{*1.2} \quad (11)$$

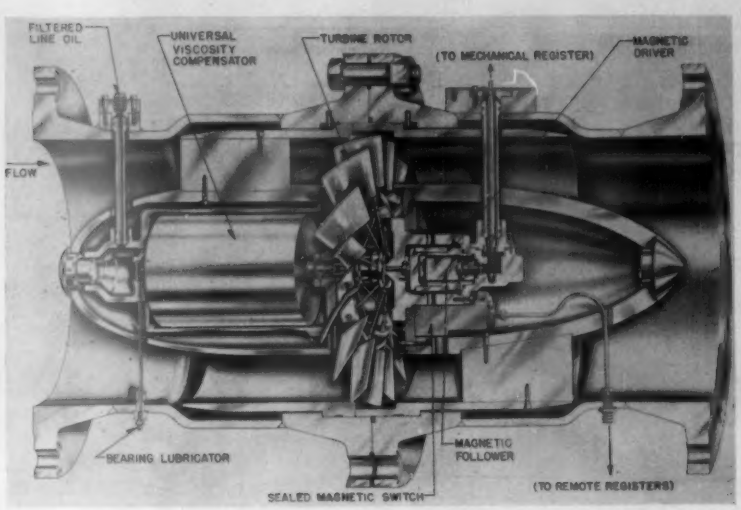
which can be rearranged into

$$K\rho v\Delta v = K\rho v^2 L - \rho v^2 x^* (K - K/R^{*1.2} \quad (12)$$

but of course, as defined, $K - K/R^{*1.2} = K$, from Equation 9, and



TEST-STAND diagram shows equipment for testing meters. Fig. 6.



CUTAWAY view of compensated metering turbine. Fig. 7.

$x^* = R/K$, from Equation 10, so finally

$$K\rho v\Delta v = K\rho v^2 (L - K/R)$$

and

$$\Delta v/v \simeq K - (K/R) \qquad (13)$$

Fig. 3 plots the entire range of $(\Delta v/v)$ as a function of Reynolds number and as will be noted—again acting as a reminder that all this refers to a well-designed metering turbine—that it is nothing but two hyperbolas intersecting at $R = R^*$.

The turbine slip $(\Delta v/v)$ is now well defined, but not constant; that is, not satisfactory. The cure, however, now is also clear: It consists in adding a slip (K/R) equal and opposite to the offending term (K/R) of Equation 13, and this is very easily done as follows:

We are all familiar with the type of viscometer which consists of one concentric cylinder rotated inside another, with a small clearance filled with the liquid in question.

Such a viscometer constitutes a simple case of laminar shearing and, referred to the mean radius of the two cylinders, the drag force (F') exerted by the one cylinder on the other is simply

$$F' = K\mu v'$$

(where μ = viscosity of the liquid) (14)

and v' is the speed difference between the cylinders. If such a viscometer is directly turned by the turbine rotor, $v' = Ku = Kv$. The force balance then becomes

$$K\rho\Delta v' = K\mu v \qquad (15)$$

or the additional slip due to the viscometer is

$$(\Delta v/v)' = (K\mu/\rho v) = K/R \qquad (16)$$

adding the slip contribution from Equation 16 to Equation 13, we have finally solved the problem, or

$$\Delta v/v \simeq K - (K/R + (K/R = K \qquad (17)$$

or

$$\Delta v/v \simeq \text{const} \qquad (18)$$

in a compensated metering turbine, as shown diagrammatically in Fig. 4, which is useful in the entire Reynolds-number range above R^*, or, simply, in the entire transition and turbulent range of pipe flows of liquids of any composition and viscosity.

Compensated Calibration Curve

In the foregoing, we defined the calibration factor in Equation 1 as

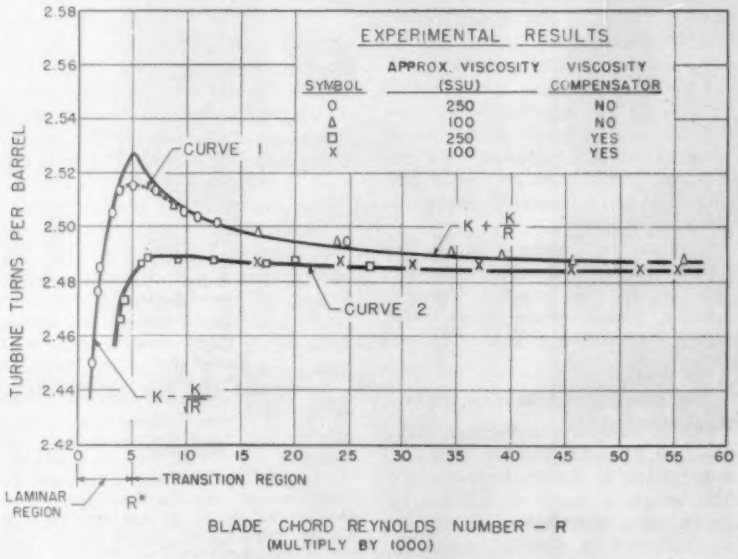
$$(Kv - \Delta v)/v = K - (\Delta v/v)$$

Fig. 5 is a plot of the calibration factor $= K - \Delta v/v$ against Reynolds number which is simply the curves of Fig. 3 inverted. The full-line curves are hyperbolic curves $K - (K - R^{1\text{-}2})$ and $K + K/R$ developed previously, while the dotted-line curve is the theoretical calibration-factor curve of a fully compensated metering turbine according to the above theory.

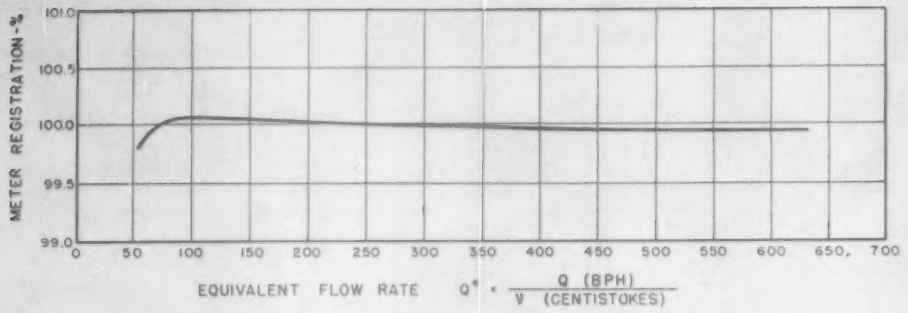
Testing a Compensated Metering Turbine

From now on we shall speak specifically of a compensated metering turbine which has been carefully tested in the field and in our large-meter test stand. The test stand is shown in Fig. 6. One thousand barrels of viscous oil similar to U. S. crude oils is pumped at a maximum flow rate of 15,000 bbl. per hour through 16-in. piping into the test meter and delivered to another tank on a 350,000-lb. scale, accurate to the neraest 50 lb. The rate of flow can be held nearly constant at any rate down to 3,000 bbl. per hour, which is 20% of the rated capacity of the meter.

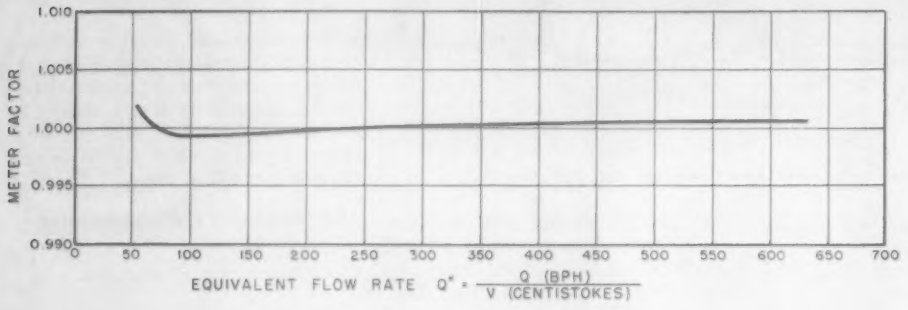
The simplest test is "on the fly," or at constant speed, and in order to avoid reading errors, the volume register (on the meter) and the weight register (on the tank) are photographed simultaneously at the beginning and end of a test run. The actual viscosity of the test oil of course varies with temperature, but the conversion factor from weight to volume is determined by a pycnometer and



TEST CURVES of metering turbine. Fig. 8.



PERCENTAGE registration as a function of "equivalent flow rate." Fig. 9.



"METER FACTOR" as a function of "equivalent flow rate." Fig. 10.

also by a Westphal balance. The overall accuracy of the stand approaches one part in 10,000 or 0.01%, which is then our limit of physical significance of test readings.

The Compensated-Metering Turbine

Fig. 7 shows a cutaway of the actual meter. The front half of the casing carries the inlet portion of the venturi (or torpedo) which guides the flow into the blading and houses the viscometer or universal viscosity compensator mentioned previously. The running clearance between the viscometer cylinders is about 0.040 in. It sounds small, but field tests passing nearly 40 million barrels of various crudes left no deposits in this clearance.

A small amount of line fluid was driven by the pipe-head loss through an external filter and visual-flow indicator to insure that the oil delivered to the viscometer was the same as other line oil.

The rear half of the housing carries the outlet portion of the venturi, which recovers head loss and supports the rotor bearings, all in the rear portion. The rotor runs in a recess with ample mechanical clearance (about ¼ in.) and turns the viscometer through a simple dog clutch.

The rear end of the rotor shaft turns a magnetic driver which, through an absolute seal, turns a magnetic follower which, in turn, operates the upshaft and conventional p.d. meter registers, including ticket printers if desired. The return flux from the magnetic driver actuates sealed explosion-proof magnetic switches, which close circuits at any suitable voltage to operate electronic counters (and ticket printers) at any distance without need for amplification.

The test results of the meter of Fig. 7 are shown in Fig. 8. Curve 1 of Fig. 8 shows the experimentally determined accuracy curve of the meter before the universal viscosity compensator was added. Superimposed on Curve 1 are the theoretically determined meter characteristic curves of Fig. 5. After the viscosity compensator was added to the meter of Fig. 7, the new accuracy curve was flattened as shown by the experimentally determined accuracy curve of the compensated meter (Curve 2).

External lubricators are provided for all ball bearings. We found, after field tests on about 40 million barrels of various crudes, absolutely no mechanical deterioration or, more convincingly, no measurable change in calibration.

As a matter of general interest, we have tested this and similar meters in turn on gas, air, stoddard solvent, gasoline, kerosene, and even water, with no appreciable change in calibration.

The Universal Calibration Curve

Fig. 8 showed a calibration curve based on Reynolds number. This is of little interest to the practical operator, who selects a meter of suitable capacity and is interested in determining its calibration in various liquids. Fig. 9 is Fig. 8 redrawn for a particular meter, with "meter registration" plotted against what we will call "equivalent flow rate" (Q^*). To the operator, equivalent flow rate is simply actual flow rate (Q) divided by actual kinematic viscosity (ν) of the liquid, but it may be of interest to point out that it has a simple physical meaning. Let us give an example:

Assume the flow rate to be 15,000 bbl. per hour and the actual kinematic viscosity to be 50 centistokes (which is about 232 S.s.u.). The equivalent flow is then 15,000/50 = 300 which means that the meter calibration at 15,000 bbl. per hour is exactly the same as it would be in water at 70° F. (ν = 1 centistroke) at 300 bbl. per hour. Let us stress that this curve is completely universal; it will hold for crude soil, gasoline, hydrochloride acid, milk, or even beer. It makes no difference to the meter, in the metering range, so long as the fluid is homogeneous.

Practical operators generally prefer a "meter factor" curve. This curve is shown on Fig. 10, which is simply the reciprocal of Fig. 9. The meter factor is now determined once for all, regardless of the nature of the liquid. This meter factor will remain constant as long as the meter is unobstructed and the bearings are relatively clean.

Reference

[1] "A Study of Viscosity Effect and Its Compensation on Turbine-Type Flowmeters," by W. F. Z. Lee and Henning Karlby, submitted on March 30, 1959, to the ASME Research Committee on Fluid Meters for possible publication.

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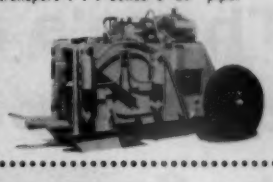

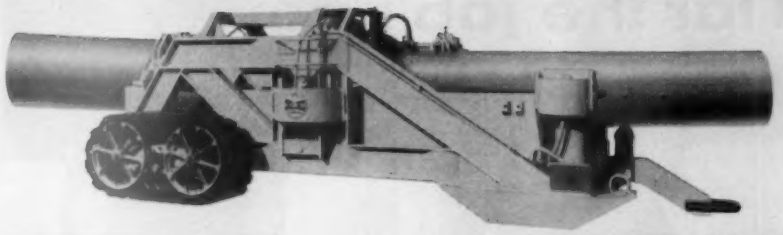

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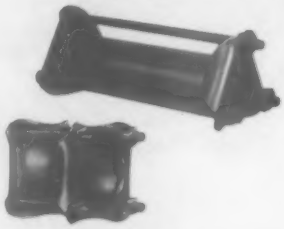

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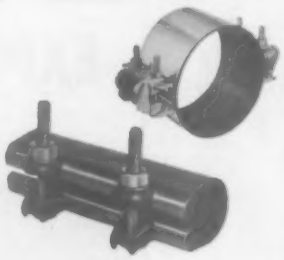

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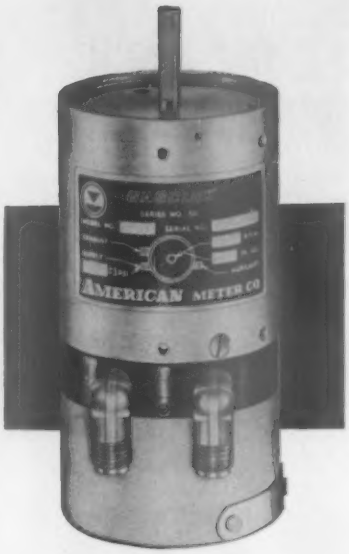

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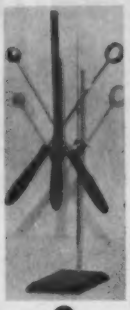
1



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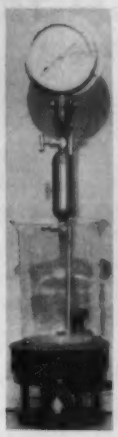

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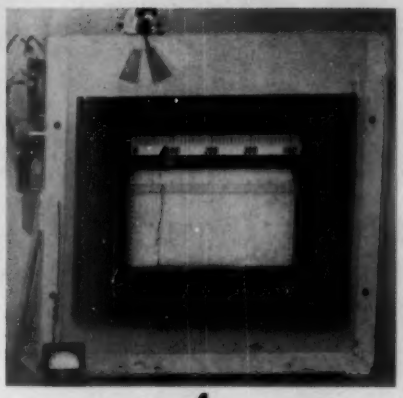

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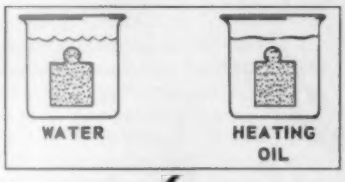
5

HERE are nine demonstrations showing properties of heat and temperature, based on the preceding lesson. Equipment used in each of the demonstrations listed below is illustrated above or at left. The first three demonstrations show that matter expands when heated.



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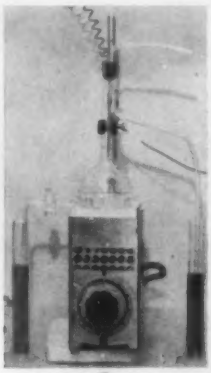


8

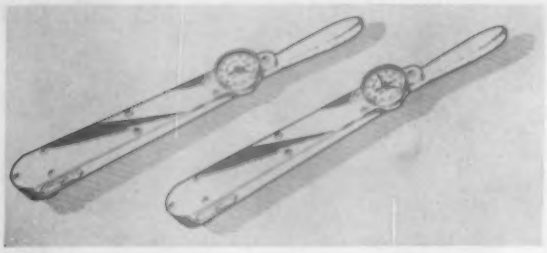
9

1. Gases—When sample bomb is heated, balloon is inflated.
2. Solids—The ball went through the ring when cold, but not when hot.
3. Liquids—Liquids trapped in exchangers, lines, compressor cooling jackets, etc., can be heated by sun, stream tracers, etc., and create large and destructive pressures. Heating this bomb a few degrees increased pressure from 0 to over 60 psig.
4. Most refinery temperature-indicating and controlling instruments use the electrical voltage generated by two different metals (a thermocouple) when heated.
5. Ice melted and water heated to boiling point in flask at right. No temperature change (a) while ice is melting, and (b) while water is boiling. Steam is superheated in coil at left.
6. Beakers containing 1,000-g. weights. Weights heated to same temperature. Equal weights of water and heating oil at room temperature added to separate beakers and stirred. Temperature of heating oil rises more than water because it has lower specific heat.
7. Piece of glass tubing. Bottle filled with colored water. Heat from hand makes liquid expand up column (like thermometer).
8. Flask containing water. Graduates containing 10 cc. water at room temperature. Procedure: (a) Boil water, (b) run 10 cc. hot water (212° F.) in left flask, (c) condense 10 cc. (liquid volume) steam in right flask, (d) much higher temperature rise in right flask, showing higher heat content in steam than in hot water.
9. Lower part of glass tube containing water was put into freezing mixture. Water in top part froze, because condensation of water vapor in lower bulb caused vacuum which made water in top bulb evaporate rapidly. Large latent heat necessary to evaporate water came out of water left behind, causing it to freeze.

This material taken from process-training-program manual, Bayway, N. J., refinery of Esso Standard Oil Co.

▶▶▶ New Equipment Section

This week's SHOWCASE features . . .



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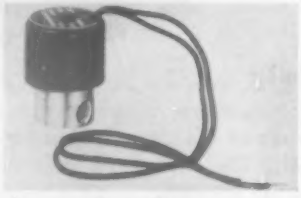
. . . and can be valuable for inspection of proper nut tightness on high-pressure processing equipment and pipe flanges to reduce the danger of leakage. It can also be used to check for proper tension on cylinder-head nuts and bearing-cap nuts on stationary engines.

Two types of the torque meter are made. The slip-pointer type has a needle on the dial which does not move until the torquing operation is completed. When pressure is released, the needle moves to register the amount of torque that was applied.

The followup pointer type has two needles. Both move as long as pressure is applied. When pressure is released, one needle drops back to zero. The other needle stays at the reading attained.

Pointers on both tools work in either direction on the dial. The torque meters come with square drive in sizes from ¼ to 1 in. and for torque ranges from 0-15 lb.-in. to 0-1,000 lb.-ft. Delivery time: 1 week. Price: from about $30 to $210. Source: **Snap-On Tools Corp. 8098 Twenty-eighth Avenue, Kenosha, Wis.**



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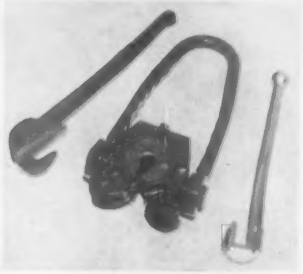

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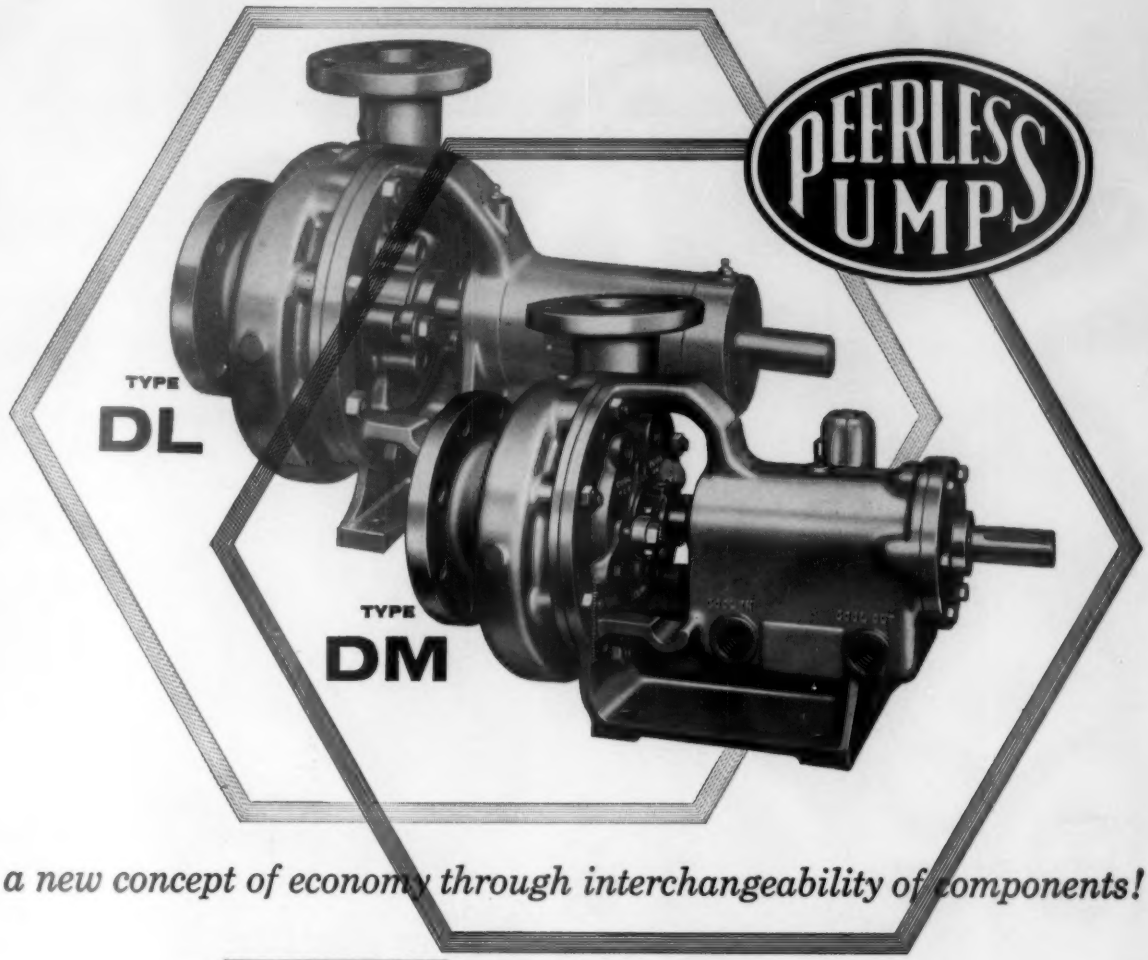

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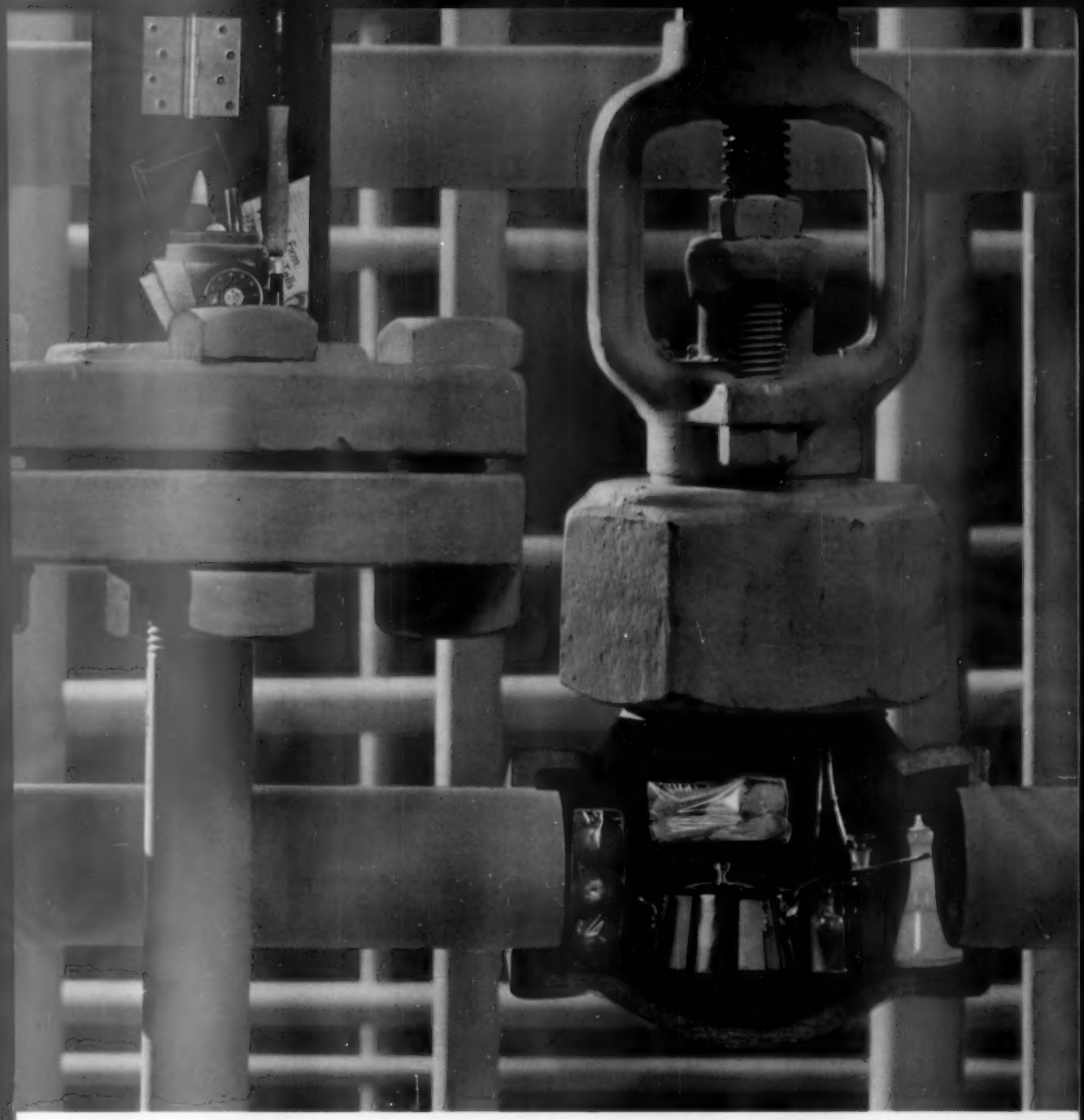

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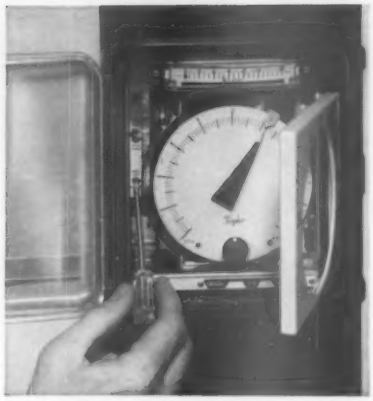
The new 90K Series pneumatic Dial Indicator brings you TRANSCOPE efficiency . . . with the initial economy of process variable indication only. It can be quickly interchanged with the TRANSCOPE Recorder, thanks to plug-in connections. 90K features include:

- Color-coded target-type pointers against full 10″ scale—for exceptionally easy reading.
- Powerful "Servomatic" powered pointers—assure precisely accurate pointer positioning.
- Front-of-panel control response settings give results at a glance.
- Same standardized components as in the 90J Recorder—minimum parts inventory necessary.
- In a control station, continuous indication of set, process and valve pressure.

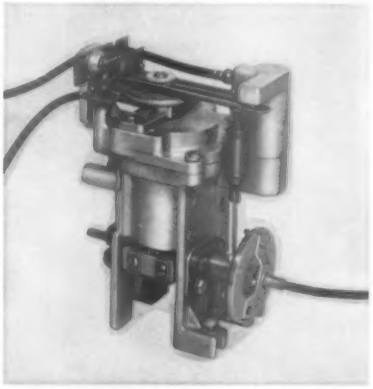
Optional features include: indication of a second variable on a separate dial; Cascade switch for pneumatic set control; electric or pneumatic process alarms.

For full details, call your Taylor Field Engineer, or write for **Catalog 98347.** Taylor Instrument Companies, Rochester 1, New York, or Toronto, Ontario.

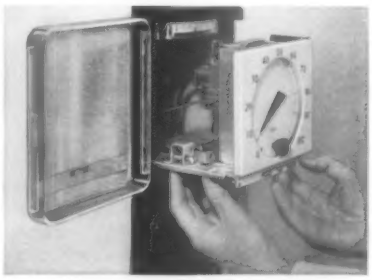
*Reg. U.S. Pat. Off.



Front of Panel Adjustments. Gain, Reset and Pre-Act* response adjustments can be changed where you see the results while making the change.



Servo-operated Pointers are positioned with 150 times greater power than with conventional bellows, which also permits one or two high-low process alarms—electric or pneumatic.



PLUG-IN Connections. The main slide, including indicator and set point transmitting mechanism, is removed by loosening one holding screw.

Taylor Instruments **MEAN ACCURACY FIRST**

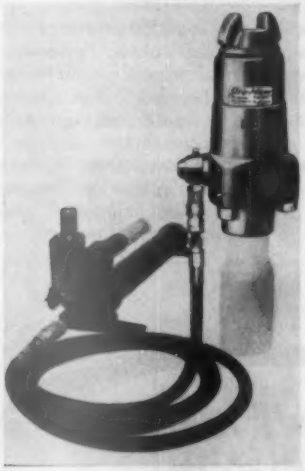
SHOWCASE . . .

New Equipment

Chemical cuts fire hazard of oil

. . . and gasoline spills, the maker says, either on land or water. Called Slix, it is a chemical hydrate emulsion formula. It can be used as an anti-coalescing agent to break up an oil film into globules. It chemically coats each droplet and isolates it with an area of noncombustible water of hydration. This emulsion can then be easily washed away with water.

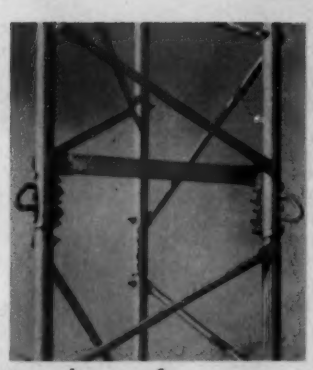
Available for immediate delivery, the chemical sells for about $2.75 a gal. Source: **Penetone Co., 74 Hudson Avenue, Tenafly, N. J.**



More safety for wire-line operations

. . . is achieved by the use of hydraulic power to operate this wire-line oil saver. Called the Strip-Master, it is designed for easy and fast operation and maintenance. Packing can be changed simply by unscrewing the top nut. No lines have to be disconnected. An indicator at the hand pump tells packing condition so the operator can change packing before it wears out.

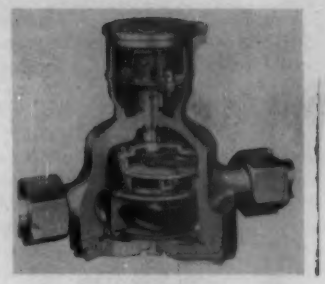
The hydraulic action of the unit compresses cylindrical packing tightly around the line. Two models of the unit are made. Model HR passes 1¼-in. rope socket and sinker bar. Model HL clears 2-in. tubing swab and cups. This unit can save time as it does away with the need to break out the oil saver to replace cups. Source: **Bell Rubber Co., Box 4426, Station A, Dallas 8.**



New line of communications towers

. . . just disclosed feature a three-sided sectional design. Made of high-strength alloy steel, the towers offer heights from 10 to 500 ft. They are built to meet or surpass the Electronic Industry Association windloading and other standards. Sections are either 10 or 20 ft. long and come in four weights.

The heaviest towers can be raised to 500 ft. with 30-lb. per sq.-ft. windloading. Sections are fastened by drive-fit, high-carbon-steel bolts. Source: **Motorola, Inc., 4501 West Augusta Boulevard, Chicago 51.**



Water-flooding meter for 2,000 psi.

. . . operating pressure measures up to 20 g.p.m. of water. It promises to prove useful for metering water injected at each flooding point. Called the Five Pointer Model 504, the meter has 1¼-in. straight male threads with swivel connections for ½-in., ¾-in., or 1-in. pipe. It operates on the nutating disk principle of positive liquid displacement.

The unit of registration is a straight-reading nonreset register in gallons or barrels with a totalizer capacity of 5 digits. Available from stock, the meter sells for about $80. Source: **Rockwell Mfg. Co., 400 North Lexington Avenue, Pittsburgh 8, Pa.**

designed for profit . . .

H & M Accessories mean faster, easier pipe cutting & beveling

MOTORIZED UNIT provides fully automatic operation for H&M pipe cutting and beveling machines. Motors are built for consistent, smooth operation . . . steady power.

FLEXIBLE SHAFT . . . allows one man complete visibility when cutting pipe. Regulates speed of torch at all times. Attaches easily to any H&M Machine.

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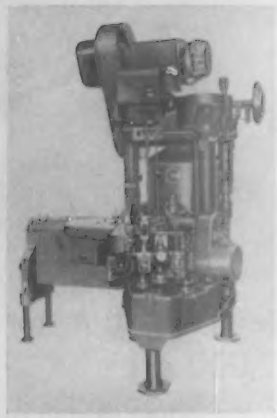


Machine closes, embosses cans

. . . at the rate of sixty 1-qt. cans a minute. Potential uses include 1-qt. oil and antifreeze cans. The Model 450-HCM closing machine comprises several components that depend upon the user's needs. These include a motor bracket, marker, filler drive, explosionproof electrical attachments, universal floorstand, 90° discharge with idler sprocket, and atmospheric change parts.

The machine's seaming mechanism and cover feed can be adjusted to handle aluminum cans. Delivery time is about 90 days. The machine rents for about $2,800 a year and sells for about $27,650. Source: **Continental Can Co., 100 East Forty-Second Street, New York 17.**

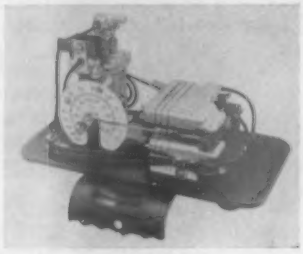
●

Convenience featured in hand drill

. . . now on the market. The ½-in. special drill is fitted with a switch that lets you apply full power to the auger in reverse to cause it to virtually back itself out of a drilled hole.

A trigger switch permits on-off control of power. The on-off and reverse switches are wired to prevent damage to the motor through carelessness or unintentional pressing of the wrong one. Capacity of the drill is ½ in. in steel, ¾ in. in masonry with a special bit, 1 in. in hardwood with an auger, and up to 1½ in. in sheet metal with hole saws. Available for immediate delivery, the drill sells for about $60. Source: **Black & Decker Mfg. Co., Towson 4, Md.**

●



Flow readout, control simplified

. . . with a new function generator now on the market that converts a pneumatic input signal into a characterized output. It can be used to linearize the signal from a differential-pressure type of flow transmitter and thus obtain quicker and more accurate readout on linear scales and charts. Too, optional interchangeable cams can be obtained to preform an un-

When you THINK of mechanical well logging . . . you naturally think of the GEOLOGRAPH RECORDER

This is our "Fifth-of-a-Century" of superior service to the oil industry. GEOLOGRAPH recorders give you the most complete record available while the well is drilling.

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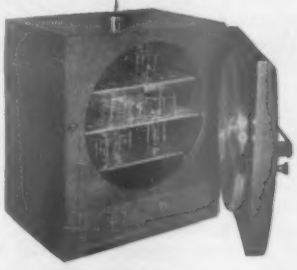
Write for Bulletin 58.



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SHOWCASE . . .

New Equipment

limited variety of functions in addition to linearization of flow measurement.

Typical applications include ratioing of flows involving viscous liquids and slurries, cascade control involving flow, temperature, pressure, or liquid level, and totalizing several measured variables such as temperature and flow. Available from stock, the function generator sells for about $200. Source: **Taylor Instrument Companies, 95 Ames Street, Rochester 1, N. Y.**

●

Welding used to strengthen derrick

. . . for drilling from floating vessels so it will better withstand forces imposed by the rolling action of a floating vessel. Measuring about the same as a conventional size derrick, 140 ft. high with a 30-ft. square base, the derrick consists of 16 welded sections with pin connections. According to the maker, the welded-section design reduces the number of connections in the structure as compared to designs wherein all individual members are bolted together.

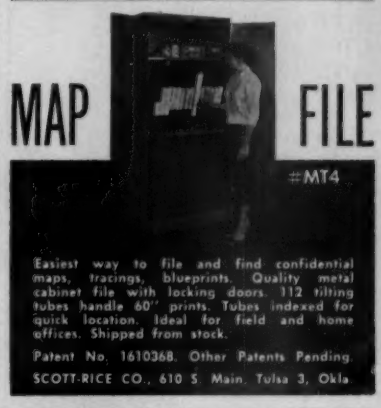
To keep the traveling block from swinging, the maker has incorporated a vertical track and roller device that acts as a guide for the block. Designed to withstand actual wind loads of 100 m.p.h. with a full pipe setback, the derrick has a gross capacity of 952,000 lb. Source: **Lee C. Moore Corp., Tulsa.**

●

Valve makes thick grease move

. . . by producing an almost absolute vacuum. This causes atmospheric pressure to collapse the viscous mass into a vacuum pocket, thus providing a constant supply in the gear chamber for positive dispensing with a metering accuracy within 2%.

The Eco Gear-Vac valve promises to prove useful for handling small flows of heavy greases and other viscous fluids with viscosities up to 250,000 S.s.U. No heating or pressurizing is required to induce flow through the valve. The valve can be manual or motor-operated. Suited for temperatures to 450° F., the valve sells for about $265 to $360 and is available from stock. Source: **Eco Engineering Co., 12 New York Avenue, Newark 1, N. J.**



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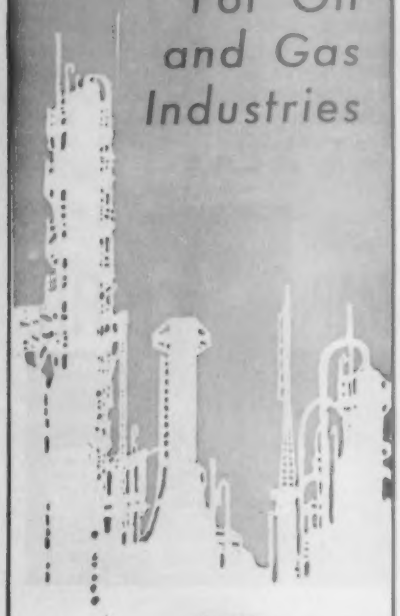
For Oil and Gas Industries



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SHOWCASE . . .

New Literature

Chromatography recorder bulletin

. . . details the Series 143X electronic strip-chart instrument with features designed especially for vapor phase chromatography recording. Two-page Specification S153-21 points out such features as continuous standardization, low-inertia pen carriage, high resolution slidewire, and provision to add accessories such as a retransmitting slidewire, a manual chart-speed changer, limit switches, and recorder feet for portable use. Source: **Minneapolis-Honeywell Regulator Co., Wayne and Windrim Streets, Philadelphin 44.**

Measurement and control equipment

. . . Bulletin PI-959 includes specifications, applications, and operating characteristics of AccuRay onstream instrumentation. Included are: (1) continuous level measurement systems; (2) tank or bin level detector-controller; (3) continuous density-measuring systems; (4) container fill-control systems; (5) container inspection-rejection system; and (6) the pipe-wall thickness gage. Source: **Industrial Nucleonics Corp., 650 Ackerman Road, Columbus 14, Ohio.**

Dual-fuel-system folder

. . . presents a concise explanation of the system which permits a diesel engine to burn gaseous fuels, including natural gas and sewage gas, as well as diesel oil. Engines with the system can be used in stationary power plants and pumping stations. Folder EG-B46 offers cutaway drawings, system advantages, and a typical control system. Source: **Enterprise Engine & Machinery Co., Eighteenth and Florida Streets, San Francisco.**

Conventional gate valves brochure

. . . also contains special tracing templates of the valves. These drafting aids permit you to check the actual size of various valve configurations with respect to your fluid-system blueprint. Actual-size outline drawings in-

Oakite

ECP. . .

Best way to clean a storage tank

RECORDS show that the best way to clean a storage tank interior is the Oakite ECP way . . . which recommends *mechanized* cleaning where possible. One unit that had accumulated especially thick, tarry deposits through long service in crude and asphalt storage was . . . after a short day and a half of *detergent spraying* . . . pronounced 100 per cent clean by inspectors.

Oakite's ENGINEERED CLEANING PROGRAM offers the chemical approach to cleaning. It takes into account *your* soil problems, *your* cleaning needs, *your* equipment.

The Oakite Engineer develops the ECP to *your* needs. *And*, he sticks with the operation 'til you're satisfied. For you, Oakite ECP means thorough cleaning in the shortest possible time . . . savings from faster turnaround . . . freeing men for other work.

Invite the Oakite Engineer in on *your* cleaning problems. Oakite Products, Inc., 39 Rector St., New York 6, N. Y.

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your economy key

In our 50th year

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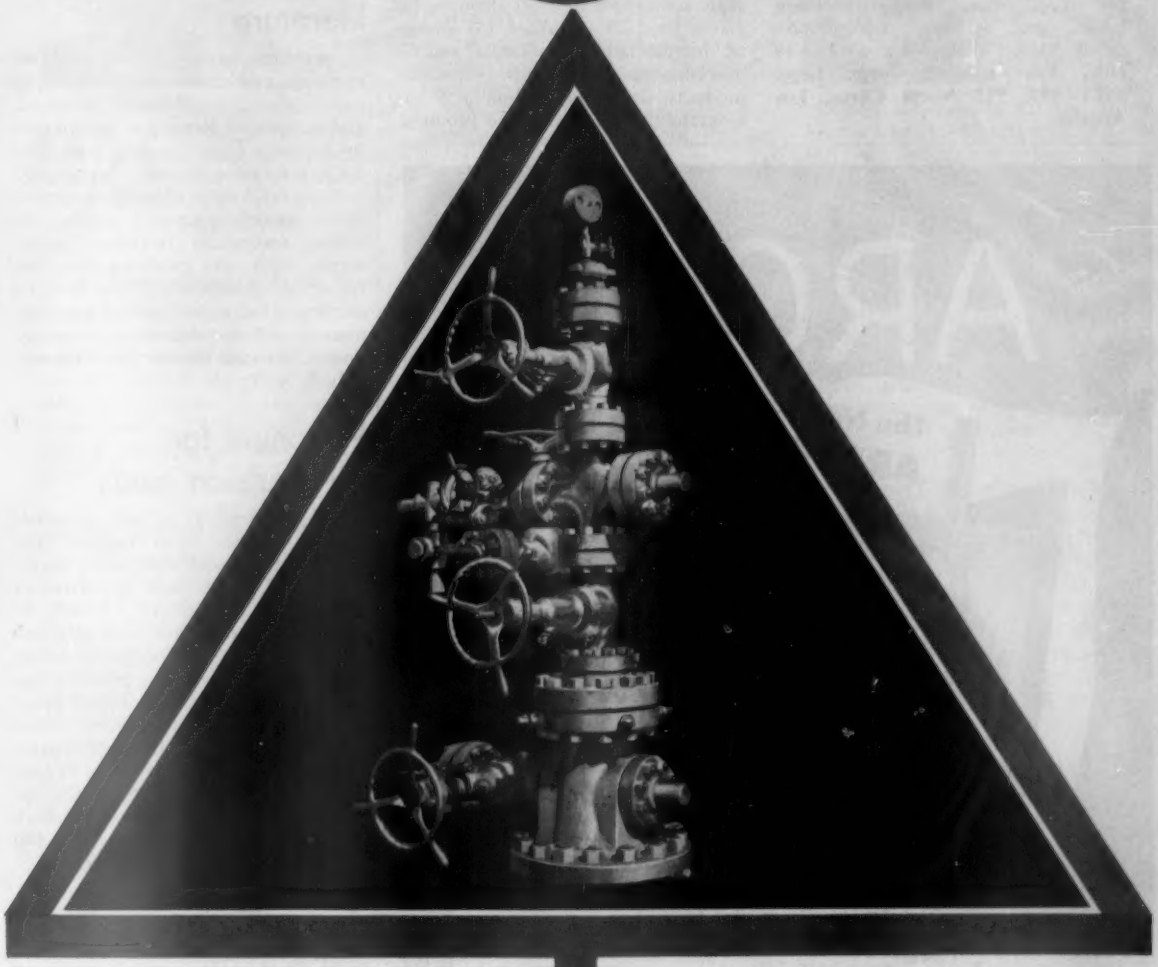

WE'D LIKE TO BE . . . ON

YOUR CHRISTMAS TREE

This is the season in which to remember . . . and be remembered.

Orbit Valve Company's personnel — wherever they may be — appreciate the opportunity of serving a truly great industry during this year and the many years of the past.

We sincerely wish a Happy and Prosperous New Year for everyone throughout the oil industry.

ORBIT VALVE COMPANY • TULSA, OKLAHOMA

cluded on the templates are inserted in a special envelope at the back of the brochure. Thus, you can select the optimum size and configurations of gate valves and insert each drawing under or over vellums of the fluid system. You may then refer to detailed tables in the publication to help you select the proper valve. The four-page illustrated brochure includes easy-to-use specification tables, dimension tables, and actuator configuration tables. Source: **Whittaker Controls Div., Telecomputing Corp., Dept. SMA 550, 915 North Citrus, Los Angeles.**

Industrial and specialty chemicals

. . . offered by Eastman Chemical Products, Inc., are outlined in a newly published product index. The listing features data on physical properties as well as shipping information, and is classified into seven sections: (1) acids and anhydrides, (2) alcohols, (3) plasticizers, (4) aldehydes, (5) aromatic intermediates, (6) solvents, and (7) miscellaneous chemicals. Specialty products, described in Bulletin P-102 separately, include cellulose products, petroleum additives, epolene (low-molecular-weight polyethylene) and isobutyrate. In addition, a section is devoted to newly developed products now available for evaluation. Source: **Eastman Chemical Products, Inc., Kingsport, Tenn.**

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The New
ARRCO-ANUBIS
RD-B (Dry-Air)
GAS
GRAVITOMETER
FULLY
COMPENSATES
FOR BAROMETRIC
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CHANGES
With the new ARRCO-Anubis RD-B Gas Gravitometer you get a highly accurate record of the specific gravity of gases... *fully compensated for changes in barometric pressure* as well as changes in temperature and humidity. It employs two columns; one for gas, one for "dry air." The difference in weight between the "dry air" and the gas in these two columns is measured and recorded in terms of specific gravity. A floating lever attached to the unit of a 6" aneroid barometer assures that the recorded gravity will always be corrected for barometric pressure changes.
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★ For Recording
★ For Transmitting
★ For Controlling
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Send for Bulletin No. 101-R3

Recording-instruments literature

. . . provides buying information, dimensions and chart speeds, operating specifications, applications, features, and accessories. Recorders are grouped by accuracy class (¼, 1, 2, and 3%) for convenient selections. Twelve-page Bulletin GEA-6933 offers photographs of all models discussed. It also describes specialized recording instruments such as spectrophotometers, recording vibrometers, automatic oscillographs, self-balancing potentiometers, and speed-recording systems. Source: **General Electric Co., Schenectady 5, N. Y.**

Petronate for oil-emulsion muds

. . . is discussed in a new literature piece, available upon request. The bulletin shows that addition of Petronate HL-G to the usual oil-clay-water emulsion in amounts of 1.5 to 2 lb. per bbl., improves oil-in-water emulsion drilling muds. The literature explains that the addition provides improved wetting and lubricating properties, low water loss, ability to be thinned with water without oil separation, low surface tension of the filtrate, and faster drilling rate. Complete application and test data is included. Source: **L. Sonneborn Sons, Inc., 300 Park Avenue South, New York 10.**

Audio-tone systems publication

. . . explains a simple, convenient method of telemetering, monitoring, indicating, and controlling. Bulletin 5906 states that the systems are especially advantageous where audio tones can be transmitted over leased telephone lines. Many frequencies may be transmitted over the same pair of wires by an oscillator for each tone. Filters at the receiving end pick out only the frequency signal for which each is designed. Combination systems, that is, audio tone (a.c.) for telemetering, and d.c. for indication and control, are possible by incorporating a circuit scanner, according to the bulletin. Source: **Femco, Inc., Irwin, Pa.**

▶ ▶ ▶ Equipment Men Notes

D. Brian Wheeler is appointed

D. B. Wheeler

. . . director of sales engineering for White Truck Division, White Motor Co., reports H. D. Weller, vice president, sales of the Cleveland truck firm.

Wheeler, who had been in charge of stress analysis and all mathematical work for White since 1951, replaces William L. Peterson, new manager of the White truck sales, parts, and service branch in Philadelphia.

U. S. Steel appoints E. B. Speer

. . . administrative vice president of central operations (steel and coal), succeeding Edwin H. Gott who was recently named executive vice president of production. At the same time it was anonunced that R. W. Graham will succeed Speer as vice president of operations.

Ben W. Montgomery is named

B. W. Montgomery

. . . vice president in charge of Welstream Equipment Corp.'s Processing Division, which specializes in the operation of small gasoline and compression plants. The report comes from W. J. Wilson, Welstream's executive vice president.

Montgomery, formerly plant manager with Cities Service Oil Co., will be located at Bridgeport, Tex. He will supervise the Processing Division's newly installed Jupiter Field gasoline plant as well as other company processing operations.

Hercules Motors Corp. makes

. . . two new sales appointments, according to William F. Humphrey, sales director.

John E. Scales, former chief engineer and sales manager of Frazier-

J. E. Scales

R. S. Miller

Wright Co., Los Angeles, has been appointed district sales manager for the Pacific Southwestern area; and Robert S. Miller takes over as manager of oil-field sales. Miller formerly worked in sales and engineering positions for Buda engine distributors and for Lufkin Foundry & Machine Co.

Walworth Co. names M. D. Louk

. . . as a sales representative in the company's Los Angeles division where he will cover much of California, Nevada, and Arizona. Louk has been employed as an oil and gas engineer for Hancock Oil Co. and, previously, as a gas engineer for Lomita Gasoline Co.

James Leitch named manager

. . . of European operations at the London office of Continental - Emsco Co., a division of Youngstown Sheet & Tube Co. A C-E employe since 1946, Leitch will supervise distribution activities in Europe, North Africa, and The Middle East. He will also head manufacturing operations at the St. Albans (near London) plant and direct business relations with the company's manufacturing licensees in France and Italy.

Meanwhile, C-E announces that its British subsidiary located at St. Albans—Emsco Engineering Co., Ltd.—will take on the new name of Continental-Emsco Co. (G.B.), Ltd. Its St. Albans plant manufactures drilling equipment, power slush pumps, pumping units, and cable tools.

Clarence H. Mingle is elevated

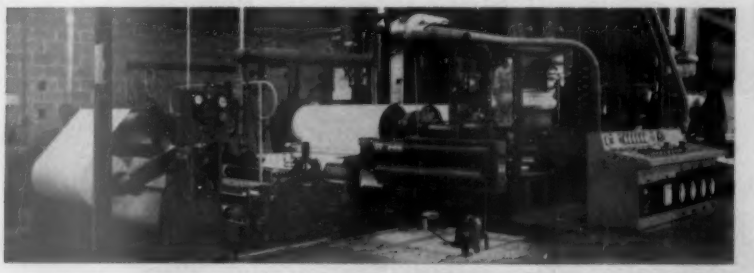
. . . to executive vice president of Gates Rubber Co. He has been a Gates vice president since 1944.

In his new post Mingle will be responsible for the coordination and direction of all Gates' sales divisions. He shares top management billing with two other Gates executive vice presidents—Charles C. Gates, Jr., and Frank S. Bosley.

Tom R. Bradley appointed veep

T. R. Bradley

. . . in charge of sales for Warner Lewis Co., division of Fram Corp., reports J. N. Fitzgerald, president of the Tulsa firm. An 8 - year Warner Lewis employe, Bradley has served as sales manager since 1955. The company supplies water separation and filtration equipment to the petroleum industry.



Plicoflex, Inc. displays new PVC compounding and calendering plant

. . . for making pipeline tape coating. The public showing took place recently at the company's new plant in Houston.

The steel-sided plant, with 40,000 sq. ft. of space, is the only one of its kind in the southwest for making tape coating of a laminate of polyvinyl chloride and butyl rubber sheets. Raw materials are weighed, blended, mixed, extruded, and calendered (as shown) into sheet form. The plant has a capacity of 7,000 sq. ft. of tape daily.

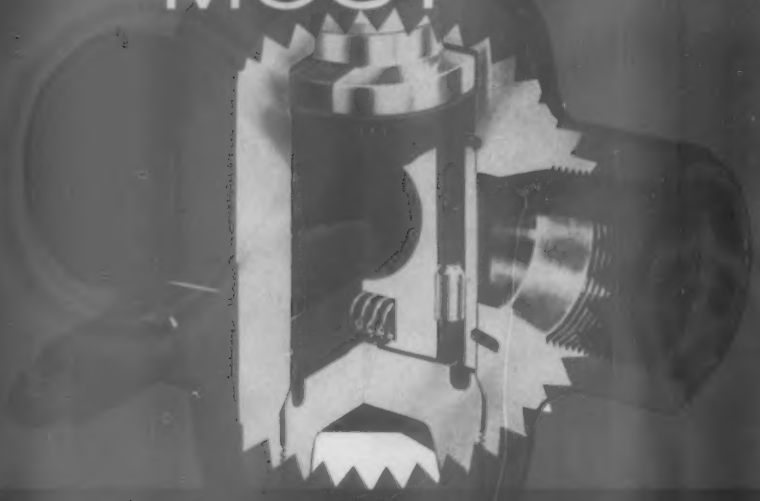
Before moving its entire operation to Houston, Plicoflex had a plant in Long Beach, Calif. D. E. Hughes, Sr., is company president.

J. W. Lowrance, Jr. takes over

. . . as production valve salesman representative in the Rocky Mountain region for Grove Valve & Regulator Co. Lowrance was formerly owner and manager of Lowrance Specialty & Service Co., engaged in sales and service of oil-field equipment.

In his new position, he will serve Grove customers in the Rocky Mountain area and the four-corners region

GET THE MOST



THE MISSION VALVE THINKS FOR ITSELF TO SEAL AUTOMATICALLY

Not only is the Mission Valve always ready to seal, but the higher the pressure the tighter the seal. Line pressure forces Mission sealant through two semi-circular grooves around the downstream port, sealing like a plastic packing, to form a gas tight seal. Leaks are stopped *automatically* before they start. **The complete line** of 315 Mission Valves brings the positive advantages of easy opening and tight sealing to practically all valve applications. This wide selection, the Mission Guarantee, and the Mission Renewal Policy combine to make Mission Valves your best buy. Specify Mission and eliminate your valve problems.

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MISSION VALVE AND PUMP CO. *a subsidiary of* MISSION MANUFACTURING CO.
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—which includes parts of New Mexico, Colorado, Arizona, and Utah. He will locate at Farmington, N. M.

Kaiser Steel Corp. appoints

C. F. Borden

..C. Fred Borden as executive vice president, announces Jack L. Ashby, president. Borden had been vice president in charge of sales since 1950. He joined Kaiser's sales department in 1945 and was named assistant general sales manager the following year. In 1947 he was appointed general sales manager.

Before joining the corporation, Borden was with Columbia Steel Co. for 9 years, first in sales and later as assistant to the vice president of the construction division.

Merla Tool Corp. appoints

... Johnnie Valdez as special sales representative for the areas of Dallas, Houston, Fort Worth, Oklahoma City, and Tulsa. Valdez has served 15 years in Merla's accounting department. The Dallas firm manufactures oil tools and equipment.

Technical Oil Tool to market

...two new instruments for fluid analysis developed by Halliburton Oil Well Cementing Co.—the Densometer and the Pitometer. The announcement was made by Grover Kilgore, vice president of Halliburton, and H. H. (Pete) Peters, president of Totco.

Technical Oil Tool Corp. will market the instruments on a rental basis for use in oil and gas-well drilling operations in the United States through its own field service organization and through its exclusive distributors—Continental-Emsco Co. and Republic Supply Co. of California.

C. W. (Bill) Floyd, Jr. becomes

C. W. Floyd, Jr.

...systems division engineer of Sargent Engineering Corp., Petroleum Production Systems Division. The report was made by W. H. Sargent, vice president in charge of oil-tool sales. Floyd was with Induflux Testing Service until 1954 as Mid-Continent manager, then with Duke Electric Co. of Odessa until late 1955. He served with Western Co. of Midland as section head of electronic research until 1958, then became a consulting electrical engineer.

American Meter Co. appoints

...Russell W. Wetjen as vice president and general manager of its newly acquired subsidiary, Granberg Corp. Active in the petroleum marketing industry for the past 25 years, Wetjen is also vice president and general manager of Buffalo Meter Co. at Buffalo, N. Y., where American will construct new testing and assembly facilities to handle demand for Granberg products east of the Mississippi.

Before becoming associated with Buffalo Meter in 1958, Wetjen was sales manager of Petroleum & Industrial Division of Neptune Meter Co. Previously he was president of Perfect Propane Gas Co., Inc., Hawley, Pa.

Jim Riseden is sales engineer

...for Service Foundry Division of Avondale Marine Ways, Inc. in New Orleans. Prior to this appointment,

ANALYSIS

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FROM ALL INDUSTRIES

Sand... heavy rain... extreme heat...

Nothing stops These Westinghouse Life-Line A Motors

dependably driving oil well pumps in Odessa, Texas district of The Atlantic Refining Company, 24 hours per day, 7 days a week!

"Here's an application," says A. P. Johnston, production engineer at The Atlantic Refining Company, "where we must have continuous motor operation . . . sometimes for as long as 18 months . . . with virtually no maintenance or repair. Many of our pumping stations are remotely located, automatic and unmanned. Any stoppage or motor failure would result in the loss of several hundred barrels of oil. Motor repairs in the field are prohibitive in cost. We must have *complete* motor reliability and that's exactly what we get from our Westinghouse Life-Line® "A" motors."

How about you? Got a really tough motor application which you can't afford to pamper? Then ask your Westinghouse sales engineer to show you how the dependable Life-Line "A" pays for itself through reduced maintenance and repair. Or write to Westinghouse Electric Corp., P.O. Box 868, 3 Gateway Center, Pittsburgh 30, Pennsylvania. J-22055-R

YOU CAN BE SURE... IF IT'S Westinghouse

On this pumping unit, the 15-hp Life-Line "A" motor operates in an atmosphere of damaging dust, sand and moisture. Despite continuous, heavy-duty service, motor has never suffered any overheating since first installed. Prelubricated bearings of the Life-Line "A" eliminate periodic greasing . . . keep lubricant in . . . dirt out.

a NEW BRADEN winch for the NEW FORD

4 wheel drive truck

BRADEN MODEL LU2-15 — a front end winch kit for the FORD F100 and F250 (4x4). Completely equipped with base angles and cable roller assembly to adapt to frame extensions for the truck, and all driving parts. This compact, lightweight winch has a safe working load of 8,000 lbs., and greatly adds to the usefulness of this new, versatile FORD truck.

The BRADEN LU2 model is also available in kits for ½ and ¾ ton (4x4) Chevrolet, Dodge, International and GMC trucks. The same type quality materials and workmanship, found in heavier winches, have gone into making this compact, easy to-operate winch. Write for information on the models you are interested in.

Replacement parts are available through BRADEN distributors or from factory

BRADEN WINCH COMPANY
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BRADEN Winches
In service around the world

Riseden was district sales manager of J. B. Beaird Co. of Shreveport.

George E. Conner elected prexy

...of Milwhite Mud Sales Co., Houston, at a board of directors' meeting held recently. Conner started with Milwhite in 1954 as a salesman. The next year he was promoted to sales manager and 2 years ago was elected to serve as executive vice president.

John Reavis is zone manager

John Reavis

...of D. W. Onan & Sons, Inc., manufacturer of electrical generating plants. He previously was president of Mechanical & Electrical Equipment Co. of Tulsa. Announcement was made by Roy E. Mullin, vice president in charge of sales.

Reavis takes over supervision of sales for Onan in Oklahoma, Texas, Arkansas, Louisiana, and Mississippi. Previous to his affiliation with the Tulsa firm, he was a salesman for Buda Engine Sales & Service.

Mechanical & Electrical Equipment Co. (Mecelec) became a distributor of Onan primary and standby electric generating plants while Reavis was president of the firm.

MOBILE DISPLAY TRUCK of Fisher Governor Co. has been introduced as an educational service to customers. The unit is equipped with sectional and working models of Fisher controllers and production equipment, an educational movie, and a supply of literature. The equipment may be either removed for display or it may be shown in the truck when the powered side panels are raised. Fisher representatives accompany the truck to demonstrate equipment and to conduct educational programs.

▶ ▶ ▶ Among the Drilling Contractors

BID FOR the world's safest rig record is Humble Oil Co.'s Rig 39 with R. J. Thames, right, in charge. Thames, field superintendent with the Humble Oil & Refining Co., has supervised the drilling of this unit during the past 5 years which on October 28 completed 566,000 man-hours of work without a disabling injury. Driller W. H. Bassett and Thames are checking the log of the well in Lake Raccourci, La., where the equipment is working. Are there any other contenders for title of "world's safest rig"?

New rig joins Libyan oil hunt

ANOTHER desert-designed drilling rig will join Camdrill International, Inc.'s, fleet. The newcomer was assembled by National Supply Co. and is en route to Libya by freighter. This drill is rated for 10,000 ft. It will be put to work on Libyan American Oil Co. leases 200 miles out in the Sahara.

Major units include a National 55 draw works, 138-ft. Ideco mast, National K-700 and K-500 slush pumps, and Medearis mud-control system. The draw works are powered by three supercharged Caterpillar D397 engines. They also power the K-700 pump through Clark 26D Torcon torque converters and a National compound. The K-500 pump is driven by another D397 engine.

Electric power is supplied by four Caterpillar electric sets—two D339 sets for the rig and two D342 cets for camp-site power.

Because of the possibility of having to operate on a variety of fuels, the engines' fuel systems have been designed to use native crude oil through installation of special filters and stainless-steel injection pumps.

Drilling share in profit-distribution plan

Camay Drilling Co., Los Angeles, a wholly owned subsidiary of Southern California Petroleum Corp., has just made its eleventh consecutive annual profit-sharing distribution. Nearly $300,000.00 has been divided among employes during this 11-year period—none to executive officers.

The present cash distribution was made to 134 eligible participants. These are dividends over and above maximum earnings and other benefits achieved through steady employment.

Despite surpluses of oil stocks and curtailed drilling activities, Camay has obtained steady work for practically all of its drilling rigs through the past year.

New project . . . Camay is joining with its French coventurer, Compagnie Industrielle de Travaux in the purchase of a big new Ideco driling rig to expand its drilling activities to Algeria. This will be the third Ideco Super 7-11 drilling rig which Citra-Camay will have in Algeria. Camay's French coventurer is new in the oil-well drilling contracting business but is one of the world's large contracting companies and is owned by Cie. Schneider.

Drilling firm renamed

A NEW NAME—Shaw-Hughes Drilling Co., Bristow, Okla.—replaces that of Doak Drilling Co. Other than the name change and the withdrawal of Howard J. Doak to devote more time to other interests, the firm will continue to operate in the same manner with present personnel and equipment.

This was brought about by the full acquisition of the company by Oras A. Shaw, Tulsa, and William M. Hughes, Bristow, both of whom have been associated with Doak Drilling during the past 10 years. Shaw is president, Hughes is vice president and general manager, and Elmer Cathey will continue as toolpusher. Shaw-Hughes has two rigs which operate in the 2,000 to 5,000-ft. range.

Doak has obtained the interests of Shaw and Hughes in American Supply Co. and he will continue to be active in that concern.

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WASH PIPE
PACKING
Engineered to work together for less friction, longer life, greatest economy!

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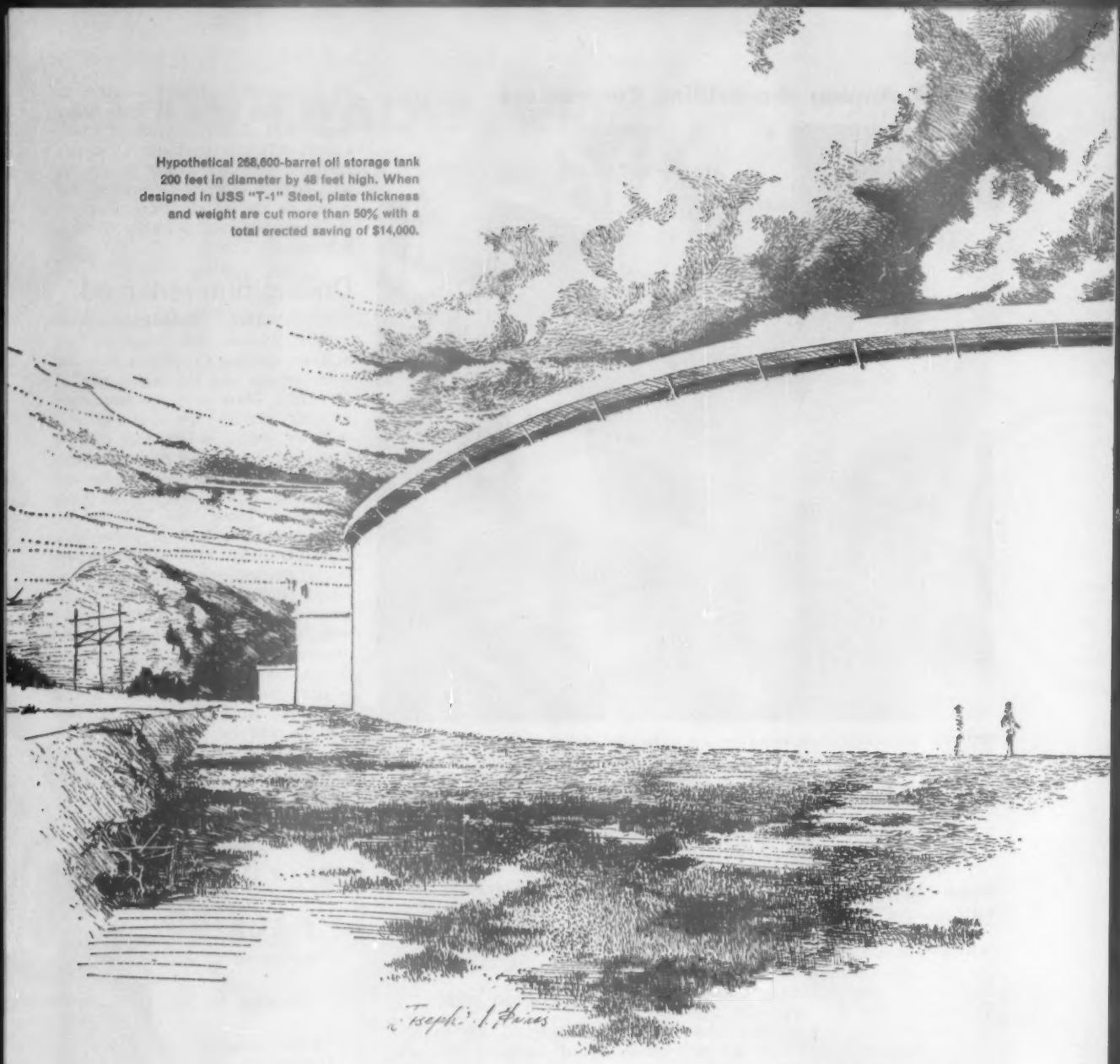


Hypothetical 268,600-barrel oil storage tank 200 feet in diameter by 48 feet high. When designed in USS "T-1" Steel, plate thickness and weight are cut more than 50% with a total erected saving of $14,000.

Design Advantages of USS "T-1" Steel

The following thickness and cost figures result from comparing *two* designs for the tank—one using ASTM A283 structural carbon steel following API Standards, the other using USS "T-1" Steel at a higher design stress than permitted by API. Note, that although a higher unit stress is used with "T-1" Steel, an even higher safety factor on yield strength is obtained.

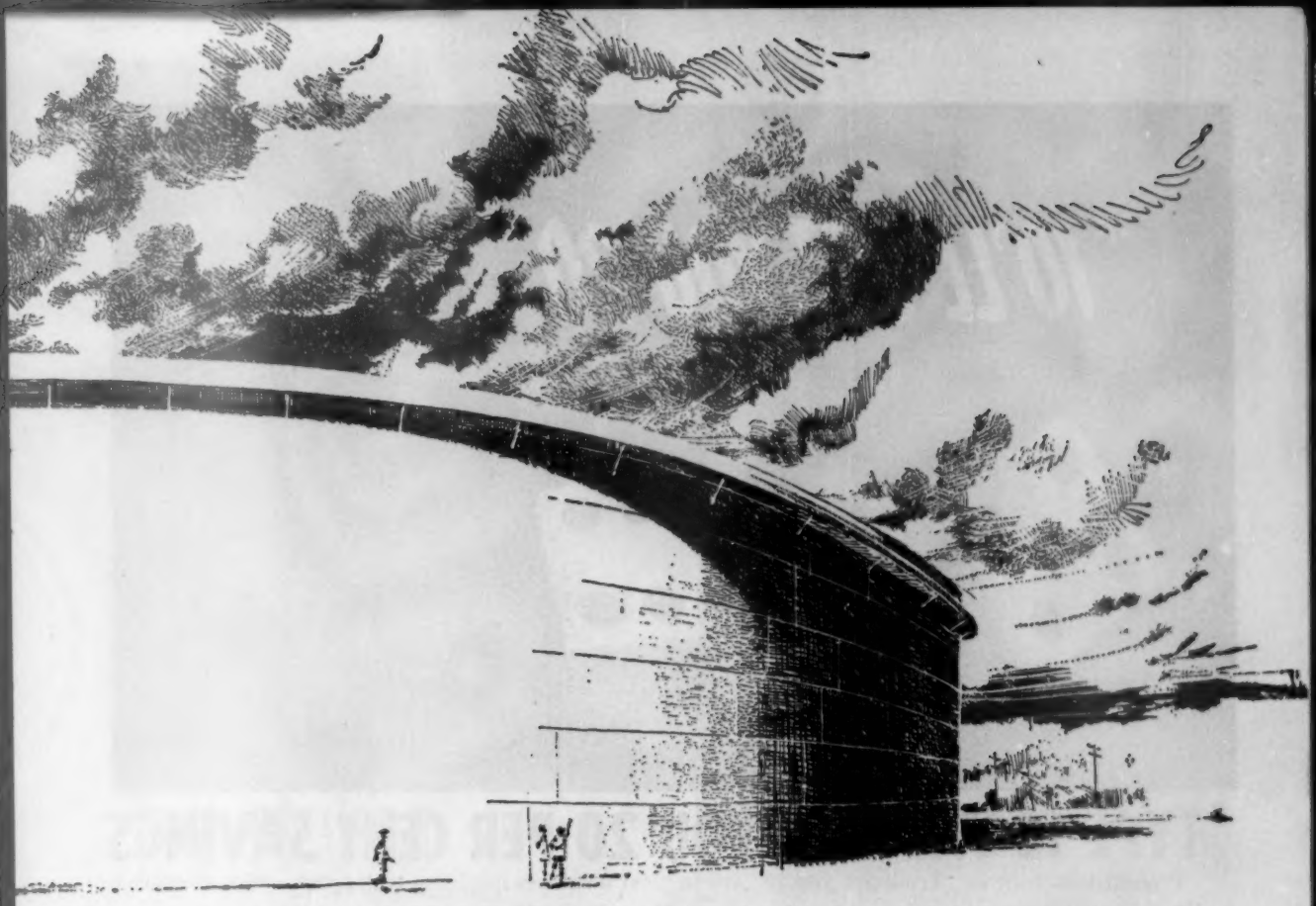
	USS "T-1" STEEL	ASTM A283 Carbon Steel
Yield Strength	100,000 psi	30,000 psi
Design Stress	50,000 psi	21,000 psi
Joint Efficiency	0.85	0.85
Working Stress	42,500 psi	17,850
Factor of Safety on Yield Strength	2.44	1.68

PLATE THICKNESSES COMPARED

	USS "T-1" STEEL	ASTM A283 Carbon Steel
Course No. 1	0.59"	1.37"
Course No. 2	0.49"	1.14"
Course No. 3	0.39"	0.91"
Course No. 4	0.3125"	0.67"
Course No. 5	0.3125"	0.44"
Course No. 6	0.3125" (A283 Steel)	0.3125"

How USS "T-1" Steel can reduce costs (compared with A283 Steel)

Material cost:	$4,400 more
but	
Fabricating cost:	$6,160 *less*
Freight cost:	$4,930 *less*
Erection cost:	$7,310 *less*
Overall savings with "T-1" Steel	$14,000



$14,000 can be saved by building this oil storage tank with USS "T-1" Steel

Here is a design for an oil storage tank that hasn't been built yet. It is 200 feet in diameter by 48 feet high. Capacity: 268,600 barrels.

The tank was designed by a well-known firm in this field—Pittsburgh-Des Moines Steel Co. The costs were estimated for both structural carbon steel to API standards and for building the tank with USS "T-1" Constructional Alloy Steel. In both cases, the bottom plates, roof plates and framing are all ASTM A283 carbon steel. The comparisons apply only to the shells.

USS "T-1" Steel construction costs less. As you can see from the chart, the total cost of the shell construction with USS "T-1" Steel is $14,000 less than with carbon steel, although the cost of the steel itself is $4,400 more. The big savings come from lower costs of fabrication, freight and erection. The reason for this is that USS "T-1" Steel's great strength (100,000 psi minimum yield strength) permits the plate thickness to be reduced more that 50% in most cases. The total steel weight is less, the thinner plates cost less to weld and ship, and fabrication costs are estimated to be lower.

Lower maintenance, too! USS "T-1" Steel has four times the resistance of carbon structural steel to atmospheric corrosion. Research has shown that paint life is extended on steels that have increased resistance to atmospheric corrosion; consequently, longer intervals between paintings is an added advantage of using USS "T-1" Steel.

Retains Toughness down to —50° F. USS "T-1" Steel's exceptional strength and toughness, even at very low temperatures, make it the ideal material not only for tanks, but for pressure vessels, equipment hauling trailers, offshore rigs and other equipment that must be built stronger but lighter. Write for a copy of our booklet, USS "T-1" Steel. United States Steel, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

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ENGINEERING LEADERSHIP 20 YEARS 1939-1959

THREE MAJOR strikes within the past month have projected Williston basin into the industry's eye, and pointed up its right to the "unexplored basin" label.

Northern Rockies swept by big strikes

BY FRANK J. GARDNER

THE ROCKY MOUNTAIN area today is in the midst of a discovery cycle that is perhaps unmatched in its history, from the standpoint of geologic significance and over-all interest. And the effects of success are being felt throughout the province from north to south, as leasing waves sweep through state after state.

Events in the southern Rockies (OGJ, Nov. 23, 1959, p. 125) are matched, if not overshadowed, by a trio of Williston basin hits in the north (see map). One of these has been finished as a 313-bbl. Devonian discovery, a second is in final testing stage, and a third is preparing to run production casing.

Remote discoveries . . . In northeastern Montana, Mobil Producing Co. has reached total depth, run logs, and is beginning tests at its F-44-20-P Mueller, 20-32n-59e, Sheridan County. This extremely important discovery lies near Dwyer, 35 miles southeast of Outlook field, Williston's most important 1957 find. It has nailed down Mission Canyon-Mississippian oil at a midbasin spot far removed from previous producing areas. Recovery on drill-stem test at 8,000-8,162 ft. was 460 ft. of muddy oil and gas-cut water, 2,024 ft. of oil, and 2,742 ft. of salt water; Mission Canyon was topped at 8,010 ft. On test of the Bakken-Mississippian at 9,292-9,384 ft., recovery was 5 ft. of mud-cut oil and 90 ft. of heavily oil and gas-cut mud; top of that formation was logged at 9,304 ft. Mobil carried the well on down into the Red River-Ordovician to total depth of 12,033 ft. Red River was entered at 11,787 ft.

Across the state line, North Dakota gained a new producing county when Amerada Petroleum Co. finished its 1 Signalness Unit in Dunn County, 10-148n-96w. On final test, this discovery flowed 313 bbl. of 41.1° oil per day on 10/64-in. choke. Producing reservoir is the Duperow-Devonian 11,533-67 ft.; total depth is 11,660 ft. The well is important not only as the first producer in Dunn County, but it is the southernmost one in the 70-mile chain of Nesson anticline fields, and projects interest in the Devonian possibilities far to the south of earlier Devonian finds. The name "Lost Bridge" has been suggested for this North Dakota strike.

The third successful thrust into the heart of Williston lies in McKenzie County, North Dakota. Here, in 15-145n-101w, Shell Oil Co. and Northern Pacific Railway Co. are running production string at the 32-15 NP, now at total depth 9,535 ft. This one is tentatively named "Medora." After topping Mission Canyon at 9,145 ft., operators ran drill-stem test at 9,319-9,418 ft. opposite the Nesson zone. This 2¼-hour test yielded 8,149 ft. of oil and 1,170 ft. of salt water. Earlier tests of the Midale-Mississippian at 9,184-9,251 ft. and of the Fryburg-Mississippian had recovered small amounts of oil.

Will attract new interest . . . These discovery events, coupled with similar ones in Paradox basin, Green River basin, Powder River basin, and northwestern Colorado, serve to underscore the slow but steady swing of the U. S. exploration pendulum to the Rocky Mountain province. Nowhere else is there so much room to play—and few spots will prove more rewarding.

First U. S.-backed

Bolivian

THE DEEPEST WELL in Bolivia became a producer a few weeks ago, and President Hernan Siles Zuazo inaugurated the well—the first since he opened Bolivia to foreign oil men in 1956.

The new producer is in the Madrejones zone, a field that extends across the border into Argentina. It was drilled by Bolivian Oil Co. This is a firm made up of various U. S. concerns, including Fish Engineering Corp., North American Utility and Construction International, Petroleum Machinery and Services Co., and Tipsa, Ltd. An oil line will permit easy shipment of crude from Madrejones into Argentina.

Bolivia looks to oil as a solution to its many economic problems. This economic anxiety was brought on by the decline in tin production, but there is hope in the little South American country today that oil will save the day. It is no exaggeration to say that Bolivia's national wealth will be coincident with the growth and success of the oil industry.

Historical sketch . . . Even before the Spanish came to Bolivia, the Indians used oil from local seeps for medicinal purposes, and, in some cases, for illumination. These oil seeps were located in the Subandean and Piedmont regions.

The first drilling for oil in South America was in 1875 in Bolivia when La Compania Corocora drilled a well near the Peruvian frontier by Lake Titicaca. Oil was found at a depth of 121.9 meters. This well reportedly made about 7 tons of oil in 20 hours.

Other attempts to find oil were made in 1916 when two wells were drilled near the Chilean frontier along the railroad connecting Arica and La Paz. These wells were drilled by a Chilean company, Caupolican - Calocoto Consolidada.

A British firm drilled two wells in the eastern part of the country near Cuevo. These drilling attempts failed mostly due to lack of funds and mechanical troubles encountered while

DRILLING ON A CREST along the eastern slope of the Andes Mountains is one of two National Type 50-A rigs used by Yacimientos Petroliferos Fiscales Bolivianos in Camiri field, Bolivia. The location is reached by a switchback road across the steep slope.

well hits pay

The first producing oil well financed by U. S. capital in Bolivia came in last month less than ½ mile from the Argentine border. Here is a look at the oil picture in Bolivia, where petroleum is beginning to play a bigger part in the nation's future.

BY JOHN C. McCASLIN
District Editor

INDEX MAP OF BOLIVIA shows oil fields and the two oil-basin trends through the country—the Subandes and the Piedmont.

drilling. Apparently, little was known of the area's geology at that time because the two wells were drilled on a very pronounced syncline to a depth of 400 meters without finding any oil.

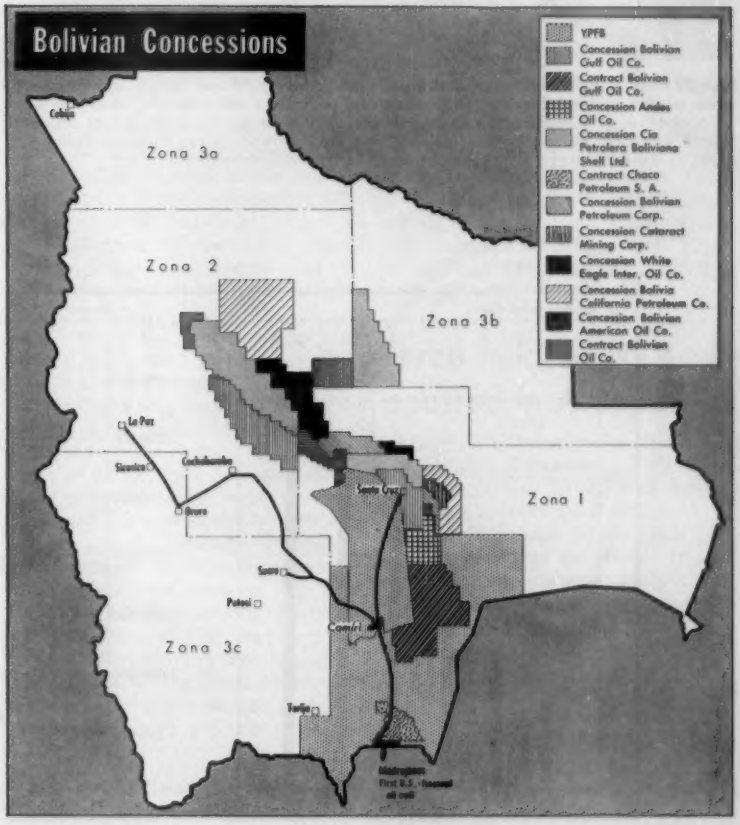
In 1920 an American company, Richmond, Levering Co., signed a contract with the Bolivian government to explore and exploit the nation's oil resources. They concentrated their efforts east of the Andes in the Subandean region.

Code established . . . In 1921 the government set up the first Petroleum Code, establishing regulations for exploring and exploiting the country's oil resources.

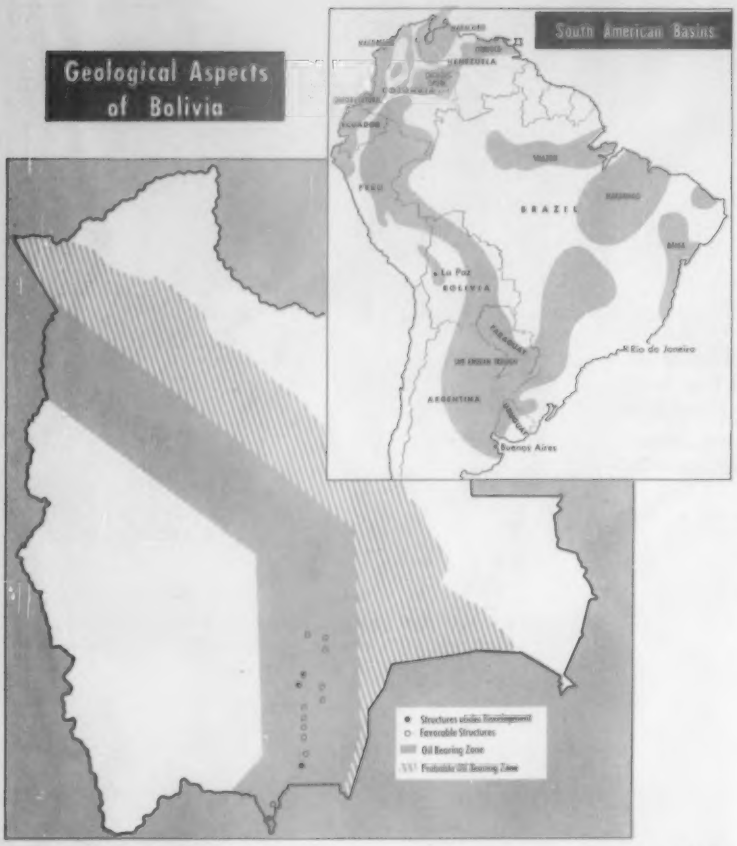
This code set down certain rules for concessionaires to follow in order to keep their concessions. In 1922 Richmond, Levering Co. transferred its properties to Standard Oil Co. of New Jersey, which in time, formed a subsidiary company called Standard Oil Co. of Bolivia. A new contract was then made with Bolivia.

. . . After a squabble with the Bolivian government in 1937 the Standard concessions were declared void and returned to the state. YPFB, the government oil company, was formed on December 21, 1936, in anticipation of this. That company took all rights to Bolivian oil reserves.

YPFB . . . From 1937 to 1952 the



BY EARLY 1959, 11 private companies financed by foreign capital had been granted concessions under the 1956 Petroleum Code.

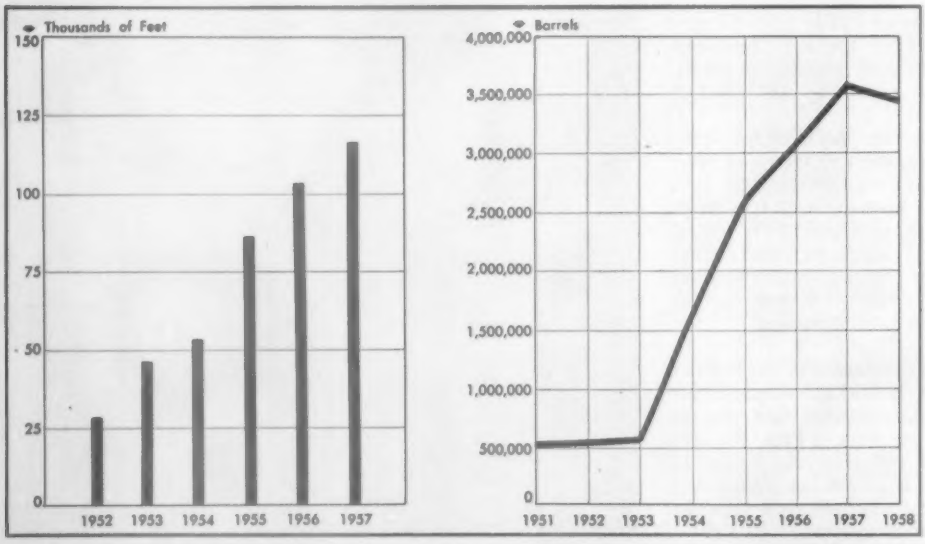


FAVORABLE STRUCTURES for drilling in the country, those being explored, the area of the country having oil production or known oil deposits, and the area of probable oil deposits are indicated above. A large syncline covers much of the central part of South America, running from Buenos Aires through Paraguay, most of Bolivia, into Peru, Ecuador, and southern Colombia.

government company worked in the southwestern part of Bolivia, especially at Camiri, Sanandita, and Bermejo. But YPFB lacked sufficient capital resources to keep production at the high level demanded by national consumption. In 1952, the Bolivian government, seeing the great future for oil in the nation, decided to help the government company in its search for oil on a much greater scale. Production, with governmental help, was intensified, the national consumer was satisfied, and for the first time in the nation's history, oil was exported. Thus, in the years 1952 and 1953 Bolivia's oil industry entered a new era.

Foreign concessionaires . . . In 1953 Glen McCarthy appeared on the Bolivian oil scene, signing the first contract for a concession of about 350,000 hectares (about 900,000 acres) from Villa Montes to Yacuiba in El Chaco. Later, in 1957, he transferred the contract by government authority to the TULM Group, a group consisting of Tennessee Gas Transmission Co., Union Oil & Gas Co. of Louisiana, Lion Oil Co. and Murphy Corp. This group actually operated under the name of Chaco Petroleum S. A.

A new oil code . . . At the end of 1956 the Bolivian Parliament approved a new oil code. At the time of this new code's birth, nine foreign companies had already entered Bolivian operations and had millions of dollars invested, but most of them had obtained



FOOTAGE DRILLED IN BOLIVIA from 1952-57 is shown at left. At right, the rising graph line illustrates how yearly oil output has shot up sharply since 1953.

concessions to the north of the zone assigned by the code to the government company. Gulf, Shell, Standard of California, Pure, White Eagle, Consolidated Cuban, Bolivian Petroleum, and Cataract are those engaged in exploratory activities. Practically all have obtained the maximum extension of land in Zone I and Zone II, and are spreading out into Zone III.

Bolivian Gulf Co. also signed a contract with YPFB in May 1956 for about 450,000 hectares for exploration within the government-owned zone. Fish Engineering Co. signed a contract with YPFB to explore 43,800 hectares in the Madrejones area in the southeastern part of the country at the Bolivian-Argentine border. This zone is thought to contain important oil reserves.

About 200 oil areas are known to exist in Bolivia, most of them along the 650-mile arc that swings down from the Subandean regions at the Peru border to the Argentine border on the southeast. There are three oil fields near the Bolivian-Argentine frontier producing more than 10,000 bbl. per day. In the zone that YPFB has assigned to it by Article 20 of the Code of Oil, there are more than 150 known structures, 50% of them possessing petroliferous potential. In the area incorporated by YPFB from the Brazilian-Bolivian agreement of 1938, there lie another 100 or more possible reservoir areas. South of the Argentine border, there are two highly productive fields that lie on structures common to both countries.

BOLIVIAN PETROLEUM DATA 1958

Production:
3,435,825 bbl.; 127 wells on production (39 flowing).

Refining:

Camiri	2,000 bbl./d.
Cochabamba	6,000 bbl./d.
Sanandita	500 bbl./d.
Sucre	4,000 bbl./d.
Total	12,500 bbl./d.

Exploration 1958:
Devonian discoveries at Camatindi: 2;
Important dry wildcats drilled: 7;
Wildcat success ratio=22%;
Field-well success ratio=88%;
Active wells: 33;
Rigs working (YPFB): 10;
Concessions available: 11;
Surface geology parties busy: 8;
Seismic crews active: 20;
Gravity and magnetometer groups busy: 3;
Mapping crews at work: 2;
Airborne magnetometer crew active: 1.

PRODUCING FIELDS

Camiri (discovered 1927).
Production: 7,481 bbl. per day.
Depth of pay: 4,500 ft.
Accumulative production: 17,268,000 bbl.

Guairuy (discovered 1947).
Production: 693 bbl. per day.
Depth of pay: 2,500 ft.
Accumulative production: 17,268,000 bbl.

Bernejo (discovered 1924).
Production: 397 bbl. per day.
Depth of pay: 4,000 ft.

Toro (discovered 1955).
Production: 754 bbl. per day.
Depth of pay: 3,000 ft.
Accumulative production: 2,287,000 bbl.

Sanandita (discovered 1927).
Production: 94 bbl. per day.
Depth of Pay: 2,300 ft.
Accumulative production: 2,112,000 bbl.

Total daily output: 9,419 bbl.
Total accumulative production: 21,667,000 bbl.

Last year's exploration in Bolivia centered on the Agua Salada-Carandayti-Mandeyapecua trend which lies in the structural extension of Argentina's Campo Duran and Madrejones fields. The structure is a slightly folded high western block, separated from a downthrown eastern block by a westward-inclined 30°-70° reverse fault. The objective here is the Tupambi sand of Carboniferous age. There were no shows in the high block of Mandeyapecua-1, Carandayti-1, and Carandayti-2; it wasn't found due to faulting in Agua Salada-1, and Mandeyapecua-2.

This year's wildcatting will take the drill into the same sandstone, only on the downfaulted block, although Chaco Agua Salada-2, now drilling, and YPFB Laguna Seca-1, planned, will test the high block only.

New deals loom . . . Agreements have been reached, or are in final states of negotiation, for extensive exploration and drilling work on three concessions in southern and Central Bolivia.

Contracts are being negotiated and letters of intent already have been signed between Uniao Brasil Bolivia de Petroles, a Brazilian company, and Kerr-McGee Oil Industries, Inc., requiring Kermac to provide management and engineering-type services on a 568,000-acre tract north and east of Camiri.

Officials of the Brazilian firm and Kermac will confer soon on detailed plans for development. UBBP hopes that drilling may begin within 10 months on 10 wells to be completed within a 3-year period.

A pact calling for exploratory work on 485,000 acres just north of Kermac's plot has been signed by Petrolio da Bolivia, S. A., a Brazilian company, and Keplinger & Wanenmacher, a Tulsa petroleum-engineering firm. A tentative $3-million drilling program during the first 4-year period by Parker Drilling Co. has been arranged.

Detailed plans for development will be outlined soon in a meeting between Keplinger interests and the Brazilian officials.

. . . Atlantic Refining Co. will receive a majority working interest on 235,000 acres north of Santa Cruz from White Eagle International Oil Co. in exchange for exploratory work there. Atlantic has an option to drill a 10,000-ft. well before July 1961 to earn an 80% interest in the concessions. A gravity survey plus completion of photogeological and magnetic studies of earlier survey findings will be handled by Atlantic.

New gas discovery for British Columbia

IN CANADA Pacific Petroleums, Ltd., today announced a substantial new gas discovery in the prolific Jedney-Bubbles-Laprise area of northeastern British Columbia, approximately 50 miles north and west of Fort St. John.

The new discovery is the most northerly production found to date in the upper Triassic and is some four miles northeast of the nearest well, Dome 1 Laprise. The well appears to be an independent structure paralleling the Jedney-Bubbles trends.

Pacific has completed four drill-stem tests resulting in gas flows totalling 4.8 M.M.c.f.d. through a total interval of 198 ft., the thickest gross pay section encountered to date in the upper Triassic. The well is drilling to the middle Triassic sand and will be completed as a dual producer if the second zone proves productive.

The discovery well is close to the gathering system of Westcoast Transmission Company, Ltd., which has the gas under contract.

Pacific is the operator for a group of oil companies which includes Sunray Oil Co., Imperial Oil Ltd., Canadian Northern Oil & Gas, Ltd., Charter Oil Co., Ltd., and Medallion Petroleums, Ltd.

Three field sizes boosted in Alberta

ALBERTA'S three major Beaverhill Lake Middle Devonian oil fields were increased in size by order of the Oil and Gas Conservation Board.

Swan Hills, the largest, had 2¼ sections added to its limits. It now contains 68¾ sections. Judy Creek was increased by 2¾ sections, while Kaybob added four sections. Judy Creek now has 25½ sections, Kaybob 30.

Production data for the three fields shows Swan Hills to have 71 oil wells capable of producing and turned out 5,866 bbl. per day; Judy Creek has 8 wells capable of producing with a daily average output of 511 bbl.; Kaybob has 49 wells making 3,061 bbl. per day.

Sooner part of Arkoma due for action

OKLAHOMA'S portion of the Arkoma basin should see plenty of gas-exploration activity soon. Republic Natural Gas Co. has reported the acquisition of a large acreage spread in eastern counties, crossing even over into western Arkansas. Leases and blocks are in Haskell, Latimer, and LeFlore counties, looping over the line into Arkansas.

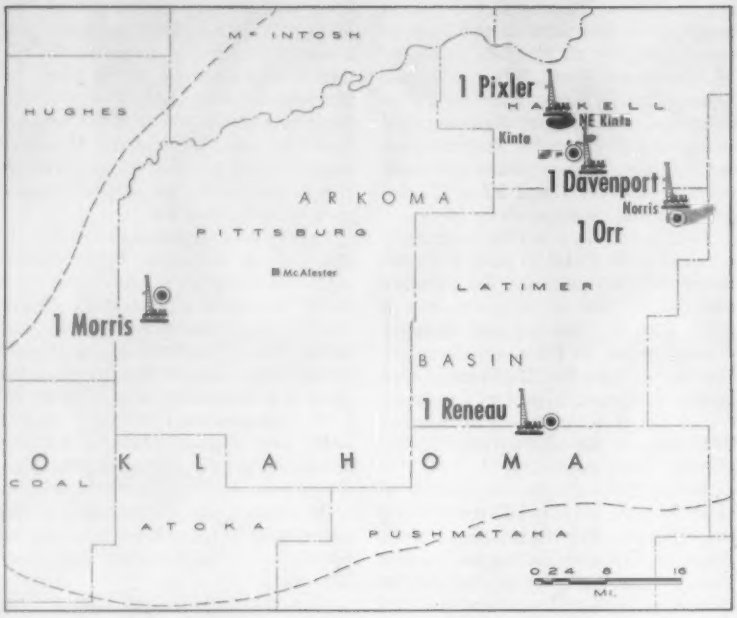
Republic, stirred by the tremendous potential of this new gas province, bought about 100,000 acres in the area. The company has been partners with others in two gas discoveries in Haskell County. Land bought up lies in 6n-19e, 6n-20e, 6n-21e, 6n-22e, 6n-23e, 6n-24e, 6n-25e, 6n-26e, 6n-27e, 7n-23e, 8n-19e, 8n-20e, and 8n-25e. Price was about $2.00 per acre.

Thick section here . . . Republic's work will be in the thickest Atoka Pennsylvanian section of the basin along the Arkansas Valley. There is an estimated 20,000-ft. section in the area just north of the Choctaw fault zone.

Recent finds . . . Exploration in this basin has been slow in recent years, but is rapidly becoming brisk in both states. Most of the work of late has been in Arkansas where several Pennslyvanian gas areas were tapped, but now the push is beginning in eastern Oklahoma.

Republic-Ambassador Oil Co. et al. 1 Davenport, NE SW NE 33-8n-20e, south of Kinta field, an old-time shallow gas area, flowed open 2,459 M.c.f.d. from basal Atoka sand at 5,550-70 ft. Another well, the 1 Pixler, C E½ NW 15-8n-20e, inside Northeast Kinta field, flowed 3,932 M.c.f.d. from Atoka at 5,490-5,502 ft.; 2,510 M.c.f.d. from Cromwell at 5,863-83 ft.

The most significant discovery of the year in the basin is Midwest Oil Co. 1 Orr in 8-6n-22e. This deep geological wildcat in Norris field flowed 17,500 M.c.f.d. from a thick Atoka sand section at 7,180-7,309 ft. Casing collapse has since delayed completion of the discovery. Another key well here is Sinclair Oil & Gas Co.'s 1 Reneau in 32-3n-20e. This well got Bigfork chert, or Viola Ordovician, production below 2,000 ft. The gas flow should be commercial when completion comes. Drilling is down to 6,400 ft. in the lower Ordovician zones. This Viola well is most important to future exploration along the southern end of the basin. It set off a flurry of leasing south of the Choctaw fault, down to the Winding Stair Mountain fault zone, thence east to Arkansas.



HERE IS southern Mid-Continent's newest gas hopeful—the Arkoma basin. This two-state complex basin lies south of the Boston Mountains and north of the Ouachita Mountains along the wide valley of the Arkansas River.

Shallow rim drilling . . . Drilling around the edges of the basin on the northwest has found good gas production.

Carter Oil Co. 1 Morris in SE SE NW 25-5n-12e, western Pittsburg County wildcat, found 5,650 M.c.f.d. in the Hartshorne Pennsylvanian sand at 3,216 to 3,378 ft.

Arkoma basin picked up a final completion last week at Carter Oil Co.'s 1 Morris, SE SE NW 24-5n-12e, southeast of shallow Stuart gas field.

This new gasser flowed 3,661 M.c.f.d. from Hartshorne Pennsylvanian perforations at 3,216 to 3,378 ft.

Bright future . . . Arkoma basin is the Mid-Continent's most promising new source of gas. Drilling has been slow here but will accelerate in the coming months. It is one of the three last wildcat frontiers in Oklahoma and it is due to fall to the drill soon.

Anadarko wells continue success

Northwestern Anadarko basin exploratory events continued to reap high success ratios.

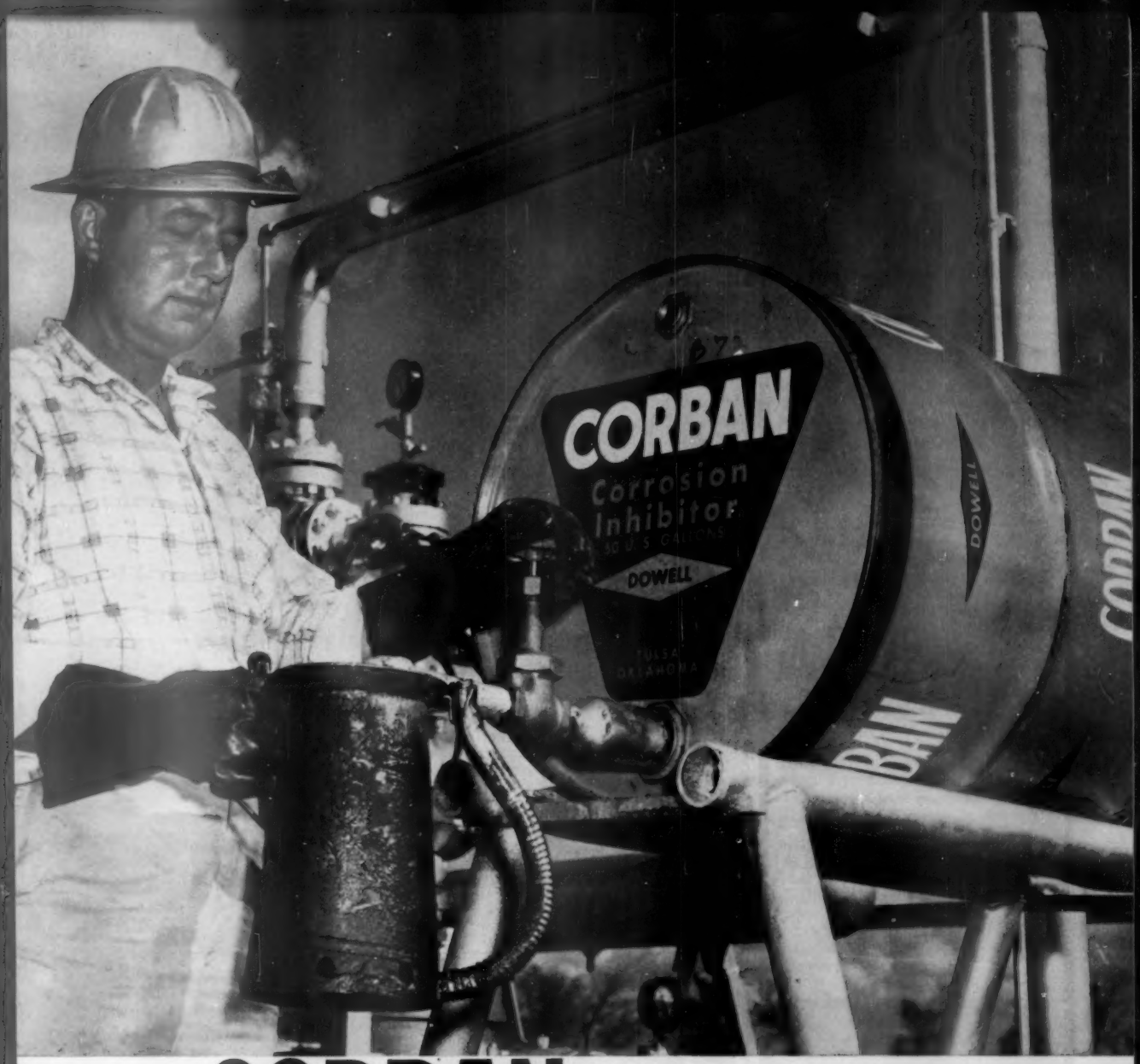
In the Texas Panhandle, Pan American Petroleum Corp. 1 Riley Unit, Section 59, Block 4-T, T&NO Survey, 2 miles northwest of Spearman, Hansford County, made 25 bbl. of oil per day from Marmaton Pennsylvanian. This well is a ½-mile-south extension to Hansford Marmaton field.

The Ellis Ranch area of Ochiltree, fast becoming a multipay reservoir of considerable importance, has another gas well. Shamrock Oil & Gas Corp. 2 C. H. Kelln, Section 919, Block 43, H&TC Survey, is shut in for potential. The well flowed 3 M.M.c.f.d. from Mississippian. It lies inside Barlow Morrow Pennsylvanian gas and oil field.

Oklahoma Panhandle . . . Stekoll Petroleum Co. continues tests at the 1 Amy Patten discovery in the northeast part of Beaver County.

The well, located in C NW SE 34-5n-28eCM, flowed 3,500 M.c.f.d. on 24/64-in. choke from Chester-Mississippian. It lies 3 miles south of Glenwood Gate Lake field.

In Texas County, Cities Service Oil Co. 1 Republic "A," 1 mile east of Morrow oil at Northwest Optima field, flowed 52 bbl. in 1 hour from 6,126-30 ft. Location is in NE NE SW 33-5n-15eCM.



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Shallow drilling spurts in West Illinois

SHALLOW, prolific oil production recently opened in Brown County, western Illinois, has set off a flurry of shallow drilling activity in Mount Sterling area. It began last month when Charles Eager brought in his 1 W. L. Davis as a 1,005-bbl. oiler from 8 in. of Edgewood-Silurian lime between 634 and 635 ft. Here William L. Davis, farmer, and Richard L. Moore, banker, look over operations 8 miles south of Timewell, Ill. Moore brought in the second well on land leased from an adjoining farm. Behind the two men stand oil-storage tanks for oil from the Davis well. Today there are a dozen rigs working the area—the score is one good producer, one apparent producer, and three dry holes. However, the dry holes are south of the discovery. Photo courtesy Illinois State Journal, Springfield.

Tristate basin adds more oil successes

DEVELOPMENTS in the Illinois basin included discoveries in Crawford and Clay counties, Illinois, and Spencer and Posey counties, Indiana.

Illinois . . . New Aux Vases Mississippian production was reported at a Crawford County wildcat, the L. S. Rister 1 Nichols Novosel, NW NE SW 8-6n-12w, 2 miles southwest of the town of Robinson. Pump potential was 135 bbl. per day after fracture from 1,506-21 ft. The well is 1½ miles from Aux Vases sand production.

In Clay County, 8 miles southeast of Edgewood, the Rosiclare lime is a new pay for the area. Willard McKinney 1 Cameron, SE SW SE 3-5n-6e, made 99 bbl. of oil per day.

Indiann . . . Spencer County continues to hold its lead over other basin areas. There were three new Jackson oil wells completed last week. All are in the prolific new area 6 miles northeast of Grandview in 6-6s-4w. A. B. Doty and Otis Greer 2 Curtis Mills, SE SE NW, pumped 200 bbl. per day from Jackson at 679-712½ ft. The 1 Nicholas Varner in NE NE SW also made 200 bbl. per day at 699-732 ft. J. C. Miller 1 Armin L. Leistner in SE NE NW made 200 bbl. per day at 702-31 ft. This is one of the most active and successful producing areas in the basin.

Howard D. Atha 5 O. B. Dorrough, SW SW NW 5-4s-13w, 1 mile east of Griffin in Posey County, was completed for 125 bbl. per day on pump from upper Palestine at 1,893-99 ft. and lower Palestine at 1,900-07 ft. This well is ¼ mile from production.

Remote Trenton test starts in Michigan

In Michigan, Hiawatha Oil Co., affiliate of Benedum-Trees, in its first Wolverine exploratory start, is moving rotary rig to 1 Bahs, C SE NE 22-

3n-7w, Barry County, 30 miles northwest of Albion pool, farthest-north point on the 25-mile-long Trenton oil play. Hiawatha acquired the block from Merrill Drilling Co. and Burks White.

● McClure Oil Co. 1 Northrup 25-5s-3w, Scipio field, was killed after 15½ days of blowing wild from Trenton. Condition of hole may force abandonment at 3,804-ft. depth.

New treatment used in Buckeye wells

IN OHIO, a third well in Berea pool, western White Eyes Township, Coshocton County, has been treated successfully by a new method known as Stratoshock.

This process is now under test in Ohio to initiate a fracture in formations which require extremely high pressures to inject a sand laden fluid. The tool used is a vacuum bottle of varying lengths which is placed adjacent to the zone to be fractured. After the bottle is in place, the hole is filled with fluid and pressure is exerted to a point (dependent upon the rating of the bottle) where the bottle implodes. Since the bottle is a near vacuum, the differential pressure is such that the fluid tends to rush down the hole thus increasing the velocity, which in turn increases the pressure exerted at the point of the extreme differential pressure.

Pressure of 2,200 lb. was observed when implosion of the 4 by 24-in. vacuum bottle occurred in Ohio Fuel Gass Co., 1 J. E. Derr, Section 7. Gage before Stratoshock was 41 M.c.f.d. from the Berea pay at 926-29 ft. Following Stratoshock, water used as the fluid was swabbed and the sand face was treated with regular fracture using 1,000 gal. of petrogel including 90 gal. of kerosine and 2,000 lb. of sand. Shut-in volume after fracture was 327 M.c.f.d.

Old Kansas field moves northward

Grunder field in Stafford County, Kansas, was extended at Houston Petroleum Co. and Sierra Petroleum Co. 1 Barstow in SW SE SE 2-25-15w, north of the discovery well of the 1943 field.

The new well got 3,510 ft. of clean, gassy, high-gravity oil on drill-stem test in Arbuckle Cambro-Ordovician at 4,422-29 ft. Location of the new find is in the southwestern part of the county on the Central Kansas uplift.

Cities Service Oil Co. opened the field in 1943, but drilling wasn't revived until 1958 when Gilead Oil & Gas Co. found 3,589 M.c.f.d. from Mississippian at 4,200 ft. The Lansing-Kansas City Cities Service Pennsylvanian field discovery well was abandoned in 1957. Houston and Sierra's well is 1 mile northeast of the Gilead well and extends the field to the north.

Dry-hole plague hits California

A RASH OF DRY HOLES on some of the state's more interesting and significant wildcats plagued California operators. Numbered among the recent failures were these tests:

...**Manix.** Sierra Oil & Gas Co. quit its Mojave Desert test 25 miles east of Barstow in the Manix region. The well, which totaled depth at 6,404 ft., was located more than 100 miles from the nearest producer in the state. In the early 1930's there was a modest amount of shallow drilling north and west of Barstow without success.

...**Vernalis.** Efforts by John M. Young, operator, to tap production associated with the active Vernalis gas field in San Joaquin County failed when his 5,137-ft. wildcat 4½ miles west of the field tested wet.

...**Mountain View.** Honolulu Oil

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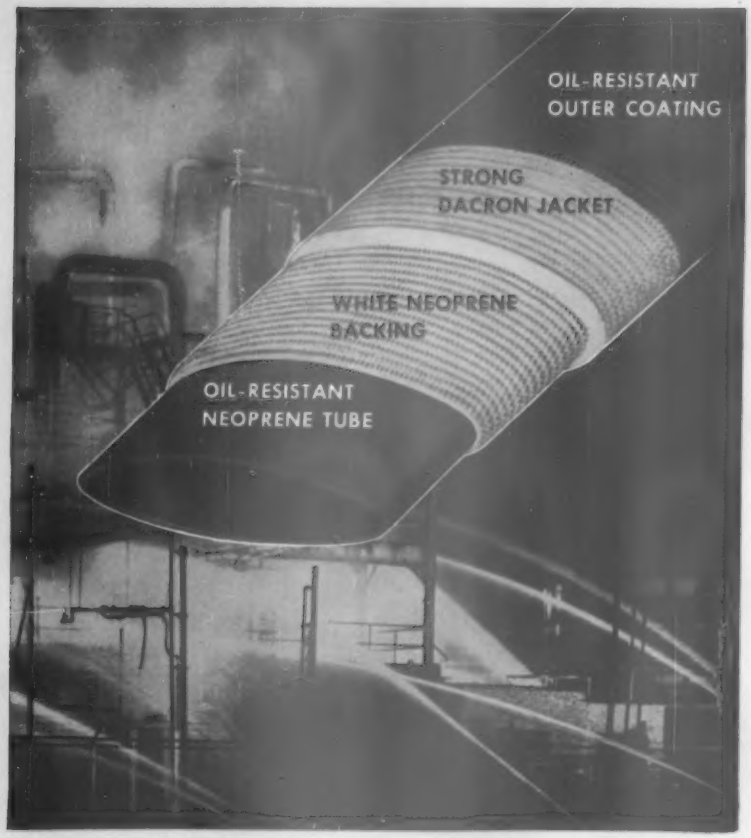

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Corp. abandoned a 12,101-ft. extension test ½ mile west of the nearest producer in this Kern County field. Texaco Inc. also quit a 10,945-ft. wildcat 2 miles south of the Mountain View-Arvin producing area.

... **Compton Landing.** Richard S. Rheem, operator, plugged and abandoned a 3,200-ft. wildcat 1½ miles northeast of production in Colusa County's Compton Landing gas field.

... **Trico.** Activity in the Trico Gas Field of Kern County was marred by a 3,301-ft. dry hole drilled by Bolsa Chica Oil Corp. 2 miles south of the field.

... **Oxnard.** Texaco Inc. suspended operations in a 8,540-ft. wildcat drilled 3 miles northeast of Oxnard field production in Ventura County. Operators had run up a string of successful southwest extensions to this field but have missed with northeast tries.

Second test slated for M-G-M movie property

Continental Oil Co. has staked location for the first followup to its recent new field discovery on the M-G-M movie lot in Culver City. This next test, 2 M-G-M, will be drilled from the same heavily guarded site on the lot using the elaborately soundproofed rig which drilled the discovery well.

Stepout completed to Alaska strike

IN ALASKA, Standard Oil Co. of California has successfully completed a stepout located 2½ miles south of the discovery well on the Swanson River unit of the Kenai Peninsula. The stepout, 12-27 SRU, produced at a rate of 482 bbl. daily from a Hemlock interval on an 11-hour production test.

A second well is slated to be drilled from the same surface location with a programed bottom ½ mile to the south, also in the Hemlock.

Drilling starts for Alaska's 1 Nulato

PAUL G. BENEDUM of Pittsburgh, chairman of a group of independent oil companies and individual operators who are carrying on a joint exploratory operation in Alaska, announced today that drilling is underway on the group's 1 Nulato unit.

Located in the Koyukuk basin in the west-central part of the forty-ninth state, this well is projected to a depth of 12,000 ft. It was spudded in Nov. 29.

In British Columbia . . .

Permission granted to build Beatton River pipeline

OIL PRODUCERS in northeastern British Columbia received a much-needed boost when the government awarded permission to Peace River Oil Pipe Line (B.C.), Ltd., for construction of an oil-transmission system.

The line, which will stretch from Beatton River field in northeast British Columbia to Sturgeon Lake oil field in northwestern Alberta—a distance of some 255 miles—will cost an estimated $9,500,000. It will deliver crude from the Beatton River, Milligan Creek, Doig River and Boundary Lake fields to refineries along its route and will eventually allow crude from that area to enter world market for the first time.

Peace River Oil Pipe Line (B.C.), Ltd., is a wholly-owned subsidiary of Peace River Oil Pipe Line Co., Ltd., which is itself owned by 32 oil-producing companies owning large producing leases in northeastern British Columbia, Alberta, and other provinces.

Peace River Oil Pipe Line Co., Ltd., presently owns and operates an oil-transmission line from the Sturgeon Lake oil field in northwestern Alberta to the Edson terminal of the Trans Mountain Oil Pipe Line Co. That latter pipeline delivers crude to Vancouver area refineries and refineries in the Puget Sound region of the northwestern United States. This new line will be extended to the northern terminus of the present Peace River system and will, for the first time, put British Columbia 'in the oil business.'

Reserves . . . The importance of the area's potential as an oil-producing region is underlined by the estimated crude-oil reserves. Consultants for the pipeline company submitted during hearings last spring, that the aggregate total proved, remaining, and probable additional oil reserves in the fields in question as of January 31, 1959, were about 155,078,000 bbl. However, it was felt that without the pipeline, development drilling would lag and exploration would fall off.

Drilling up . . . With the permit now granted, it is expected that a flurry of wells will be drilled this winter to prove up additional reserves and develop already established reserves. In this regard, the five major oil producers in the fields from which crude will be taken, namely: Imperial Oil Ltd. at Boundary Lake; Sinclair Canada Oil Co. at Doig River; Hudson's Bay Oil & Gas Co., Ltd., and Union Oil Co. of California at Milligan Creek and Triad Oil Co., Ltd., at Beatton River; have not signified their intentions. However, it is known that Imperial has at least a 25-well development program at Boundary, Sinclair will drill in the Doig River area; Union & H. B. will operate a "few" rigs all winter at Milligan Creek and at Beatton. In the last-named instance, two will be working at development wells and the remainder will be on exploratory tests.

Capacity . . . The ultimate capacity of the line from Taylor Flats to Valleyview with three intermediate pump stations is approximately 26,200 bbl. per day. It is expected that the line will be constructed during the spring and summer of 1960 and be in operation next fall.

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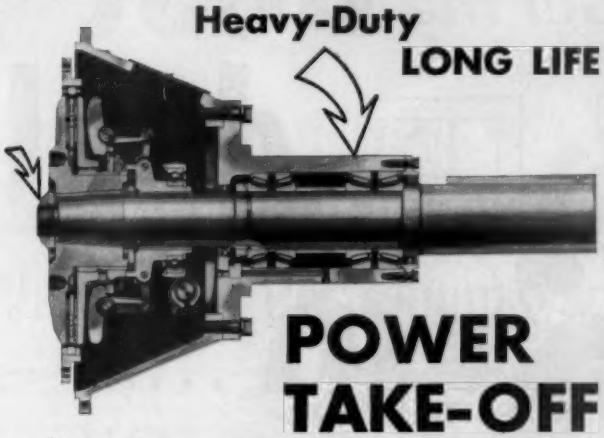

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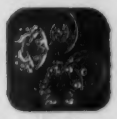

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CLUTCHES

Simonette River has five producers

ALBERTA'S Simonette River-Berland River region will be an active wildcat and field-development arena for some time to come. Two of the province's most recent Devonian D3 reef discoveries are growing into a major producing area for western Canada.

Berland River, with only one gas producer, is still one of the continent's biggest gas reserves. Followup plans are due soon. Simonette River, an oil producer, has five wells. There are two slated for immediate drilling, and a wildcat to the west of the field is starting. Two other wildcats have been staked in the area. Pan American Petroleum Corp. will drill at Bigstone, while Placid Oil Co. will drill at North Berland River.

Key deep wildcat quits in Kentucky

In Carter County, Kentucky, approximately 3 miles northeast of Olive Hill, United Fuel Gas Co. has plugged and abandoned its deep key wildcat 1 Lloyd Stamper. With 7-in. casing cemented on bottom at 5,085 ft., several attempts were made to complete as a gas well in the Cambro-Ordovician Knox and sub-Knox zones. Although it is understood some gas was had, it was not possible to separate it from copious volumes of water. No further tests have been started in the immediate area.

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New Mexico has Abo Reef prospect

A FLUSH Abo reef oil discovery is in prospect on the south edge of Vacuum field in Lea County, New Mexico.

Kewanee Oil Co. and Carper Drilling Co. 1-A Federal, 31-17s-33e, reported 363 ft. of saturated reef dolomite had been penetrated in drilling to 8,775 ft. A series of drill-stem tests conducted in the reef have yielded flows up to 24 bbl. of oil an hour, with flowing pressure up to 1,275 psi., and bottom-hole shut-in pressures up to 3,200 psi. At last report, drilling was below 8,775 ft., on contract depth of 10,000 ft., or to the Wolfcamp.

No. 1-A Federal is being drilled on a unit block in which Kewanee Oil is the major interest holder. Shallow production in the area is from the Grayburg and San Andres pays of the Maljamar field.

Top of the Abo reef at 1-A Federal was reported at 8,406 ft. It is the first Abo reef discovery for its immediate area. Interest in the Abo reef has been high since the successful redevelopment of Empire field in the Abo pay. There have been a few Abo discoveries east of Empire field (Eddy County) along the east-west trend of old producing areas.

Patrick Draw—new Almond oil hopeful

THE DISCOVERY WELL and its confirmation at Wyoming's Patrick Draw Unit, the most promising new discovery area of the Green River basin, were completed for 637 bbl. of oil per day and 1,135 bbl. daily, respectively. El Paso Natural Gas Products Co. 1 Unit in 1-18n-99w, Sweetwater County flowed 637 bbl. through ¾-in. choke from Almond Mesaverde-Cretaceous perforations between 5,182 and 5,198 ft. The No. 2 Unit in 11-18n-99w flowed 1,135 bbl. daily through 24/64-in. choke from Almond at 5,067-90 ft.

This important discovery area has two other wells staked; El Paso is coring below 4,860 ft. at No. 3 unit. Union Pacific has made location for the first offset to the north at 13-31 UP.

Patrick Draw is 4½ miles from gas and oil at Table Rock-Mesaverde

field, 6 miles southeast of Almond oil at West Desert Springs, 6 miles southwest of Almond gas at Arch Unit. Almond produces gas at Playa Unit, 5 miles north of Arch, and at Desert Springs, north of Playa. This entire Almond producing area is one of the most important developments in Green River since Desert Springs was opened a couple of years ago. The Almond has primarily been a gas producer, but now oil is entering the scene. The area between all of the above fields is wide open for future exploration to Almond because no failures have been drilled in the intervening area.

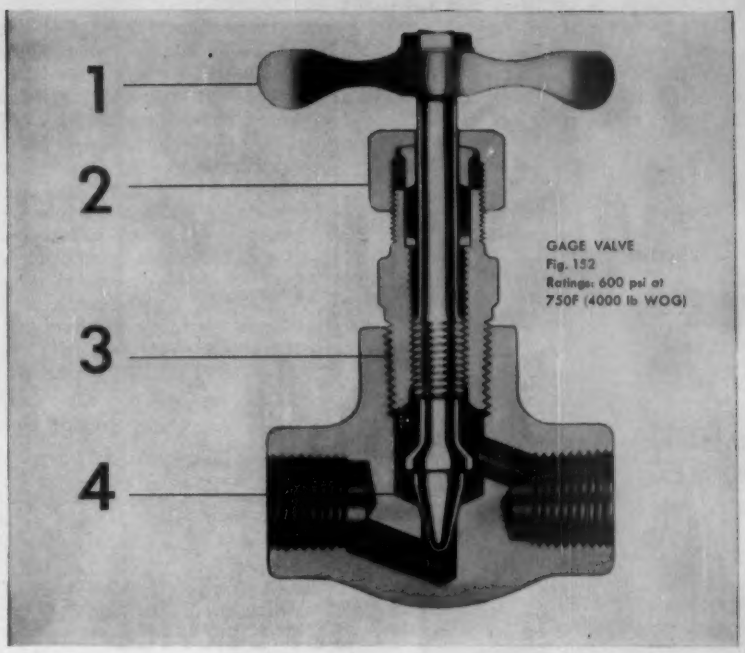
Rockies enjoy a successful week

LAST WEEK'S exploratory events in the Rocky Mountain states made it the most significant single week of the year. Leading the parade of newsmakers was Northwest Lisbon in Utah. Close behind were new discoveries in Colorado, Montana, and Wyoming. All of these areas report important strikes—some of them the most newsworthy in some time.

In Utah . . . Pure Oil Co.'s Northwest Lisbon discovery, already the highlight of the year in the Rockies, tested oil in the McCracken member of the Devonian at 8,261-93 and 8,310-48 ft. Oil recovery on swab tests was 167 bbl. in 20 hours. This is the first Devonian oil in Utah and indeed in the Southwest Rockies. The well is already a Mississippian gas discovery with flow rates up to 17,500 M.c.f.d.

Coupled with the Utah discovery is Pure's 1 Southeast Lisbon 15 miles southeast in San Miguel County, Colorado. This well tested gas at the rate of 3,295 M.c.f.d. from Mississippian, making it the first such production in the entire state. The only Mississippian production in the state is some CO_2 gas wells in the western areas.

In Montana . . . Mobil Producing Co. is running surveys at the apparent Mission Canyon Mississippian discovery, F-44-20-P Mueller in Sheridan County, northeastern Montana. Drillstem test in the Mission Canyon recovered 460 ft. of muddy oil and gas-cut water, 2,024 ft. of oil, and 2,742 ft. of salt water. A test of the Bakken Mississippian recovered 5 ft. of mud-cut oil and 90 ft. of heavily oil and gas-cut mud. Closest production to this remote discovery, one of the year's most important in the Williston basin, is at Outlook field 35 miles to the northwest.



GAGE VALVE
Fig. 152
Ratings: 600 psi at 750F (4000 lb WOG)

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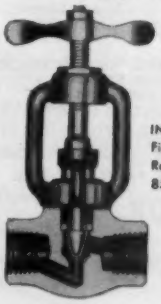
Edward Gage and Instrument Valves for Petroleum Services

Edward gage and instrument valves will give you longer, more reliable service with less maintenance cost when used on pumps, separators, oilfield christmas trees, and for meter, regulating, by-pass, and dead-end lines. Here's why.

STRONGER VALVE BODIES: Edward *gage valves* are made of drop forged steel for sounder structure and greater strength than valve bodies machined from bar stock. Available in carbon steel, 13% chromium stainless steel or 18-8 stainless steel.

Edward instrument valves have a carbon or 13% chromium stainless steel body. Carbon steel body has an integral cobalt-chromium-tungsten alloy steel seat that resists pitting and gives maximum resistance to corrosion and erosion. You have a choice of screwed or socket welding ends.



INSTRUMENT VALVE
Fig. 952
Ratings: 2500 psi at 850F (6000 lb WOG)

MANY FEATURES:

1. Contoured T-handle on both gage and instrument valves provides easy, finger-tip control.
2. On gage valves, the bonnet and packing nut are EValized (exclusive Edward plating process) to minimize galling and corrosion. Instrument valves have EValized gland and gland bolt nuts, stainless steel gland bolts.
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4. Semi-needle, integral stem-disk is made of EValloy 13% chromium or 18-8 alloy stainless steel, hardened for wear resistance on both gage and instrument valves.

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In Colorado . . . Texaco Inc. has what is probably the most important oil find in northwestern Colorado since the emergence of Rangely itself. The company tested more than 1,000 bbl. of oil per day from the Weber Pennsylvanian at a deep wildcat inside Moffat field, Moffat County. This is the best Weber find in recent years in Colorado. It should spark the predicted push to this zone throughout the Piceance Creek basin area—a play that has fizzled until now.

In Wyoming . . . Green River basin continues to cap the news in this southwestern Wyoming area. The West Desert Springs Almond Mesaverde Cretaceous oil discovery well was completed by Texas National Petroleum Co. for 300 bbl. per day on 18/64-in. choke. The 1 Government-Withers is the well that set off the current brisk campaign in the Green River to Almond oil potential. Two Almond oil wells were completed at Patrick Draw—the discovery well flowed 637 bbl. per day, the confirmation 1,135 bbl. per day.

Other Wyoming events included a blowout at El Paso Natural Gas Co.'s 7 Desert Springs Unit in Sweetwater County. The well flowed 30 M.M.c.f.d. before being killed.

Champlin Oil & Refining Co. completed the year's best strike in Powder River basin with 500 bbl. of oil per day from Minnelusa Pennsylvanian at a Crook County wildcat.

Texas' Chapel Hill has new pay

Reworking of an old Pettet gas well in the Chapel Hill field of Smith County, East Texas, has resulted in a new oil-pay discovery.

B. K. Thomas, Longview, 1 L. A. Butler is located 13 miles east of Tyler, on a 101-acre tract in the Philip Lively Survey, A-566. The well was originally drilled by Sun Oil Co. and completed as a Pettet gasser in 1941. After depletion of the gas the well was abandoned. Old total depth was 8,397 ft.

The wells new operators backed up and perforated the Lower Rodessa at 7,684-94 ft., from which the well flowed 313 bbl. of oil a day. Flowing tubing pressure was 600 psi.; gas-oil ratio measured 1,234:1.

Willow Springs workover opens new Texas oil pay

An abandoned well in Willow Springs field of eastern Gregg County, East Texas, has opened the Pettet zone as an oil pay in the area. Robert

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WITH
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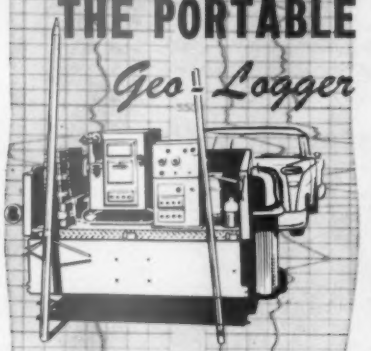
Geo-Logger



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Cargill 1 John Thomas has been recompleted from perforations at 7,419-28 ft. for a daily flowing potential of 186 bbl. of 40° oil, following a 10,000-gal. acid treatment. The flow was through ¼-in. choke, under tubing pressure of 400 psi. Gas-oil ratio was 330:1.

Operators cleaned the hole out to total depth of 7,745 ft., then set 4½-in. production string to 7,720 ft. Location is in the city limits of Longview, in City Block 730. Willow Springs produces gas from the Rodessa, Pettet and Travis Peak zones, and oil from the Travis Peak.

Texas' Pecos pool gets gas prospect

A Delaware gas discovery was indicated in Pecos County, West Texas, when the well flowed gas at the rate of 3,500 M.c.f.d. on drill-stem test.

The semiwildcat is May & Willioms 1 R. J. Merrick, 17 miles northwest of Fort Stockton and 1 mile east and slightly north of the one-well Coyanosa field. On the test, at 4,720-79 ft., gas surfaced in 1 minute and mud in 18 minutes. Recovery below the circulating sub was 60 ft. of gas-cut mud. Operators then ran 5½-in. casing to 4,787 ft. and were coring ahead.

The Coyanosa pool was opened in October by Argo Oil Corp. 1 Neal. Daily flowing potential was 542 bbl. of oil a day through ¼-in. choke, from Delaware pay at 4,782-4,800 ft.

May & Williams 1 Merrick is in Section 46, Block OW, TTRR Survey.

Deep test plugs back to Clear Fork pay

In southeastern Winkler County, West Texas, a deep and dry wildcat has been plugged back to make a good flowing discovery from a Middle Permian pay.

Chambers & Kennedy and Gulf Oil Corp. 1 Sealy-Smith Foundation, situated 14 miles southeast of Kermit and 2½ miles east of the Monahans multipay field, flowed oil at the rate of 44 bbl. an hour through 40/64-in. choke on initial tests of the Clear Fork at 5,650-71 ft., then was completed for 216 bbl. a day through smaller choke. The oil is sweet crude, of 45 gravity. Flowing tubing pressure was 525 psi.

The No. 1 Sealy-Smith was drilled to 13,267 ft. At total depth it was in the Ellenburger, but the formation top had not been determined. Well location is Section 29, Block A, G&MMB&A Survey. Nearest Clear Fork production is 4 miles to the southwest in the Winkler County portion of Monahans field.

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New-field status goes to Texas well

Discovery allowable and new-field status has been granted Gulf Oil Corp. 1 R. G. Jones in southeastern Archer County, North Texas.

Operators logged top of the pay at 5,180 ft., drilled to 5,836 ft., then plugged back for completion through perforations at 5,344-84 ft. Flowing potential was 242 bbl. of 44°-gravity oil a day.

The Mississippian opener is located on a 265-acre tract 7 miles south of Windthorst town site in Section 1898, TE&L Survey. Nearest comparable production is 2 miles to the west in Archer County Regular field. Texas Railroad Commission new-field designation is W. G. S. (Mississippian).

Significant Sooner well completed

AN IMPORTANT Springer Pennsylvanian gas discovery was completed in southwestern Oklahoma last week. It is J. M. Huber Corp. 1 Boos in C NW SW 35-5n-11w, Caddo County.

Huber finaled the well for 3,320 M.c.f.d. and some oil through perforations at 7,519-7,603 ft.; on four-point potential test the well flowed 3.34 bbl. per hour and 1,980 M.c.f.d. through 1½-in. opening. A zone down the hole at 7,928-8,056 ft. got 10,-800 M.c.f.d. and condensate; on 4-point test on ¾-in. choke, it flowed 8 bbl. per hour and 4,200 M.c.f.d.

Correction

In error, a new discovery well brought in east of Houston in eastern Harris County, Texas Gulf Coast, was reported in the November 30 issue of The Oil and Gas Journal as having been drilled by Olin Oil & Gas Corp.

The well, 2 Rudolph Weiss, was drilled by Oil and Gas Corp. of America. It was productive of gas and condensate from perforated interval at 10,-620-26 ft. It is 3 miles west of Highlands, and 9 miles from nearest other production.

Discovery wells

ARKANSAS

Calhoun County: Hughes & New Oil Co. 1-A Proetz & Barton, NE NW SE 2-16s-14w, 2⅝ miles northeast of Calion. IPP 70 BOPD, 15.8°, perf. 2,567-70 ft., Baker sand. TD 2,948 ft. Discovery well Cross Country Slough field.

Lafayette County: Janlyn Oil Co., Inc., 1 Pan American, NW SE NE 36-17s-25w, 2¾ miles northwest of Canfield. IPP 60 BOPD, net, 68% b.s.&w. 43°, GOR 1,600 cu. ft. per bbl., perf. 9,386-9,423 ft., Smackover. TD 9,444 ft. Elev. 268 ft., Cotton Valley 7,232 ft., Buckner 9,250 ft., Smackover 9,380 ft. Discovery well Field Bayou field.

Logan County: Anderson-Prichard Oil Corp. 1 O. E. Birch, 2-6n-27w, 3 miles northwest of Magazine. IP 553.7 M.c.f.d., calculated open-flow potential, TP 1,980 psi., perf. 5,818-23 ft., Atoka. TD 6,150 ft. Discovery well Magazine field.

Pope County: Gulf Oil Corp. 1 Bauman, C NE SW 13-9n-22w, 8½ miles southeast of Clarksville. Calculated open-flow potential 5 M.M.c.f.d., TP 1,190 psi., perf. 4,531-38 ft., Atoka-McGuire sand. TD 5,820 ft. Discovery well North Knoxville field.

Union County: Shuler Drilling Co., Inc., 1 Werner, SE NW SE 24-16s-17w. 4¾ miles southwest of Smackover. IPP 35 BOPD, net, 35% b.s.w., perf. 2,576-78 ft., Blossom. TD 2,730 ft. Discovery well Northwest Lisbon field.

Kinsey-Kinsey et al. 1 McPherson, 27-18s-14w, 2¼ miles southwest of Hillsboro. IP 100 BOPD, 8/64-in., 51°, GOR 446 cu. ft. per bbl., TP 425 psi., perf. 3,237-39 ft., Tuscaloosa. TD 9,196 ft. Extends Olin Forest field.

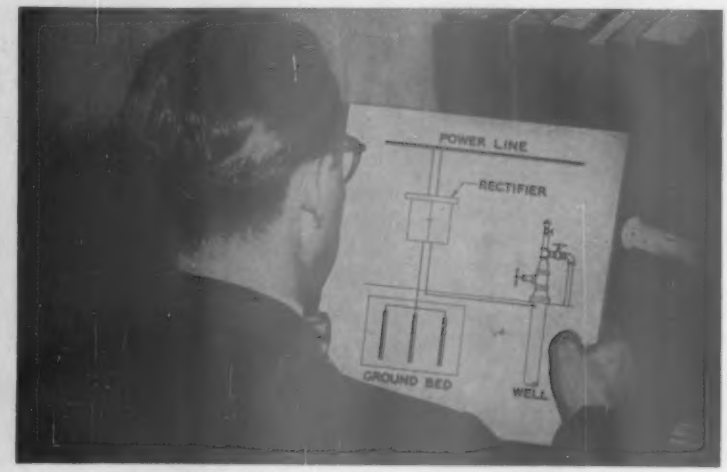
CALIFORNIA

Los Angeles County: Continental Oil Co. 1 M-G-M, NE NW 12-2s-15w, 720 BOPD, 23° gravity, perfs. between 8,000-9,000 ft., TD 11,128 ft. (New field discovery 1 mile northwest of Inglewood field).

WESTERN CANADA

Alberta: Canadian Seaboard et al. 14-20-41-3 Gilby, LSD 14, 20-41-3w5. Pekisko gas discovery. TD 7,137 ft.

Union 10-2-61-2 Westlock, LSD 10, 2-61-



HOW A MAJOR OIL COMPANY USED RECTIFIERS TO STOP CORROSION OF WELL CASING

This major oil company has 33 of its wells in a pool in northwestern Kansas. Past experience indicated that external corrosion of casing would become a major maintenance item.

The wells were surveyed to determine the amount of induced current needed for cathodic protection. Then CSI was awarded a rectifier-installation contract on a competitive bid basis. Ground beds had to be individually designed for each well to meet the two-ohms circuit resistance specified.

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COMPRESSOR QUIZ

Take this 5 minute quiz and check your knowledge of balanced opposed compressors.... ANSWERS ON NEXT PAGE. NO PEEKING!

1. What is the reason for an outboard bearing supported motor?

- ☐ Accessibility
- ☐ Shaft alignment
- ☐ Weight saving

2. Which design provides the smallest force couples?

- ☐ Bearing between the crank throws
- ☐ No bearing between the crank throws
- ☐ Both are equal

3. Structurally, what's the critical point in the multi-crank horizontal compressor from a design viewpoint?

- ☐ Lateral forces in the frame
- ☐ Vertical forces in the frame
- ☐ Cylinders

4. What type of motor is usually used on a balanced opposed compressor?

- ☐ Induction
- ☐ Engine-type synchronous
- ☐ Wound rotor

5. Can machine-mounted coolers and interstage piping be factory pre-fitted?

- ☐ Yes
- ☐ No
- ☐ Only on simple arrangements

6. Why is the balanced opposed compressor easier to install than other types of equivalent size?

- ☐ Lighter weight
- ☐ Less parts
- ☐ Semi-packaged design

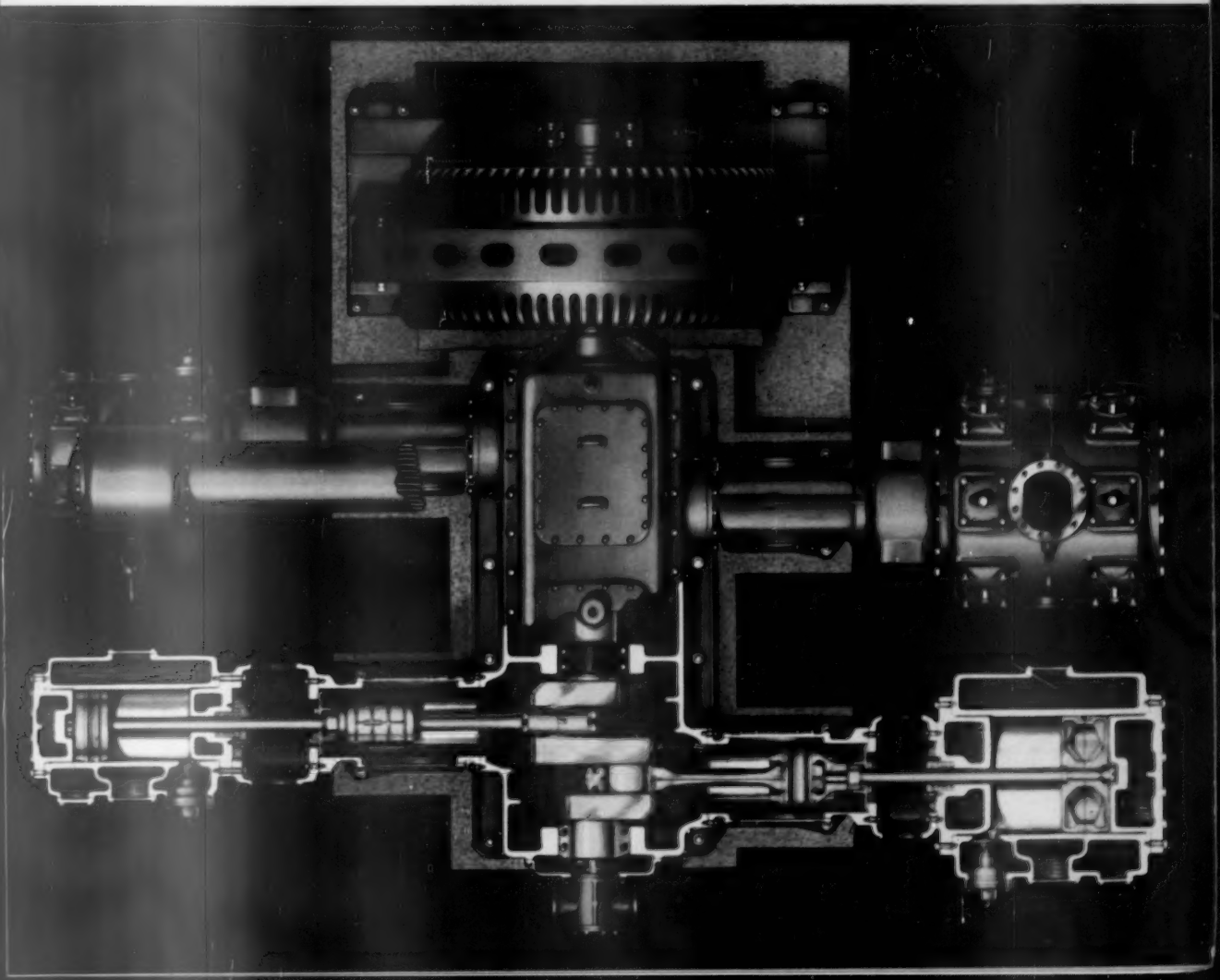
7. Is it common practice to install more than one compressor service on a single multi-cylinder frame?

- ☐ Yes
- ☐ No

8. Industry's most preferred compressor valve is standard with Worthington. It is:

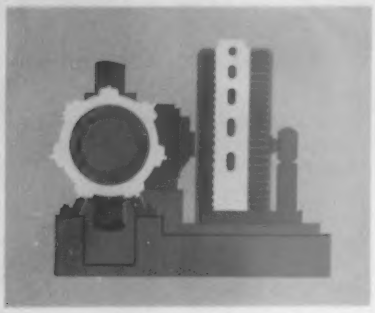
- ☐ A plate valve
- ☐ A spring activated valve
- ☐ A Feather Valve

WORTHINGTON



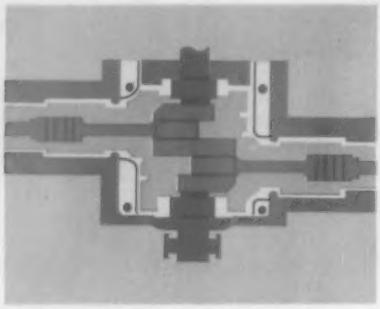
ANSWERS

to key compressor questions on previous page



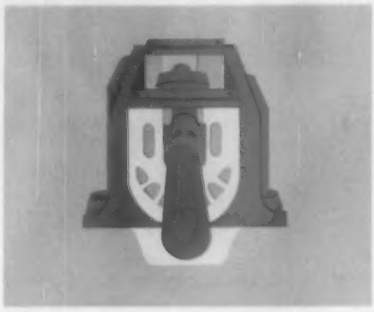
1. What is the reason for an outboard bearing supported motor?

Ans: Shaft alignment. Secure and permanent support of the large synchronous motor rotor is best obtained by placing a bearing on each side of the rotor.



2. Which design provides the smallest force couples?

Ans: No bearing between the throws. Worthington's adjacent crank design reduces couple arm to a minimum.

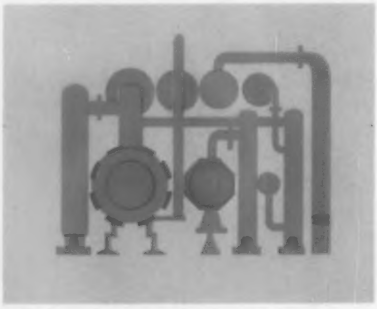


3. Structurally, what's the critical point in the multi-crank horizontal compressor from a design viewpoint?

Ans: Lateral forces in the frame which tend to distort the frame. Worthington's precision machined and fitted tie bars give solid support to the frame, preventing misalignment due to distortion.

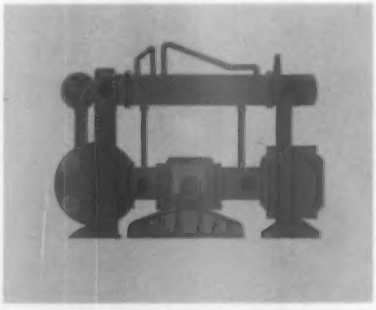
4. What type of motor is usually used on a balanced opposed compressor?

Ans: Engine-type synchronous is the major application; but complete flexibility of Worthington design permits use of any type driver, including turbine and gear or power engine.



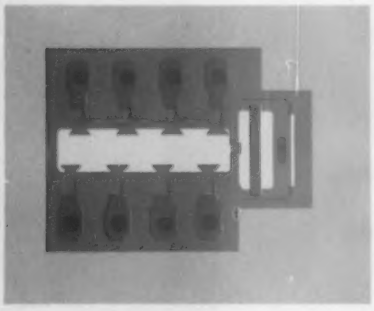
5. Can machine mounted coolers and interstage piping be factory pre-fitted?

Ans: Yes. In fact, when overhead mounted piping and coolers are furnished by Worthington, such piping and coolers are always completely assembled and fitted to the compressor before it leaves the factory.



6. Why is the balanced opposed compressor easier to install than other types of equivalent size?

Ans: Semi-packaged design. Self aligning features permit easy and sure crankshaft, frame, and motor alignment on simplified foundation. Pre-fitted coolers and piping eliminate many problems associated with multi-stage compressor installation.



7. Is it common practice to install more than one compressor service on a single multi-cylinder frame?

Ans: Yes. Particularly where the compression services are related, as in chemical plants. The arrangement results in substantial savings in initial plant cost.

8. Industry's most preferred compressor valve is standard with Worthington. It is:

Ans: Feather Valve! By actual count of 2 to 1, this outstanding compressor valve is preferred by operators and engineers.

SCORING: If you got 7 or 8 questions right you're up-to-date on balanced opposed compressors and you recognize the value of the Worthington machine. If you got 5 or 6 right you're acquainted with some of the benefits of Worthington equipment, but you need brushing up. If you got less than 5 right, get in touch with your nearest Worthington technical representative. He'll give you the full story on the many advantages of the Worthington design. Worthington Corporation, Harrison, N. J. In Canada: Worthington (Canada) Ltd., Brantford, Ont. 36.5

WORTHINGTON

2w5. Paleozoic gas discovery. TD 3,640 ft.

LOUISIANA OFFSHORE

Eugene Island Area: Shell Oil Co. 1 State Lease 3,518, Block 8 in Gulf of Mexico off St. Mary Parish. IP 38 BOPD, 3,020 M.c.f.d., 8/64-in., 47.2°, TP 8,500 psi., perf. 12,890-906 ft. TD 12,921 ft. New-field discovery.

NORTH LOUISIANA

Catahoula Parish: Olin Oil & Gas Corp. et al. 7 Olin-Tensas Fee, SE NW NW 27-5n-5e. IP 80 BOPD, 6/64-in., 43°, TP 540 psi., perf. 5,546-49 ft., Wilcox. TD 6,012 ft. New-field discovery 1¾ miles southwest of Larto Lake field.

Sabine Parish: Hilburn Industries, Inc., 1 Whitney, C NE NW 8-9n-13w. Calculated open-flow potential 6,500 M.c.f.d., 3 BC per M.M.c.f., bottom-hole pressure (shut-in) 3,050 psi., perf. 7,508-18 ft., Travis Peak. TD 8,000 ft. (Old well deepened from 5,528 ft.) New pay in. Converse field.

SOUTH LOUISIANA

Lafourche Parish: Texaco Inc., 1 Francis McGowan, 23-20s-22e, 4 miles north of Leeville field. IP 146 BOPD, 326 M.c.f.d., S-23 choke, 38.3°, TP 4,300 psi., perf. 13,552-66 ft. TD 15,783 ft. Discovery well North Leeville field.

MISSISSIPPI

Jones County: Hargrave oil Corp. and Chesley Pruet 1 Coats et al. Unit, NW NW NW SW 9-9n-13w. IP 359 BOPD, 10/64-in., 43°, TP 2,135 psi., perf. 12,907-12½ ft., Rodessa. TD 13,715 ft. Elev. 268 ft., Ferry Lake Anhydrite 12,020 ft. Revives and extends Gitano field.

Pike County: Dorris Ballew et al. 1 Holmes Unit, NW NE NE 4-3n-7e. IP 330.96 BOPD, 11/64-in., 40.9°, TP 1,535 psi., GOR 636 cu. ft. per barrel, perf. 10,-979½-11,001½ ft., lower Tuscaloosa. TD 11,040 ft. Elev. 470 ft., lower Tuscaloosa 10,900 ft. Extends new McComb field.

Walthall County: Gulf Coast Drilling & Exploration, Inc., et al. 1 S. E. Magee, NW SW SW 34-2n-12e. IPP 160 BOPD (net), 16 BWPD, 15/64-in., 36.6°, TP 200 psi., perf. 9,780-83 ft., lower Tuscaloosa. TD 10,316 ft. in Upper Cretaceous. Elev. 382 ft., lower Tuscaloosa 9,280 ft. Discovery well West Dexter field.

NEW MEXICO

Lea County: Pure Oil Co. 1-D Federal, 31-9s-36e, 3 miles southwest of Cross Roads field. IP 1,252 BOPD, 24/64-in. choke, 44°, GOR 48:1, TP 250 psi., Devonian 12,003-12,023 ft. TD 12,031 ft., elevation 4,070 ft.

OHIO

Vinton County: Ohio Fuel Gas Co. 1 E. Turner, Sec. 7, Jackson Township. IPF 1,580 M.c.f.d., rock pressure 865 psi., Clinton 2,081-90 ft. TD 2,094 ft.

NORTH TEXAS

Archer County: Anderson Oil & Gas Co. 3 Cowan-McKinney "D," Blk. 150, Robert Carson Sur., 9½ miles southeast of Mankins. IP 137 BOPD, 6/64-in. choke, 43°, GOR 500:1, TP 560 psi., Ellenburger 5,180 ft. TD 5,224 ft.

SOUTHWEST TEXAS

Dimmit County: Gulf Oil Corp. 2 Ruth McLean Bowman, Blas Reyes Grant, A-4, 4 miles north of Asherton. IP 265 BOPD, 14/64-in., 48.3°, TP 625 psi., GOR 1,387 cu. ft. per bbl., perf. 3,473½-90½ ft., Olmos. TD 6,050 ft. New-field discovery 2 miles southeast of Gulf 1 Bowman Chalk discovery.

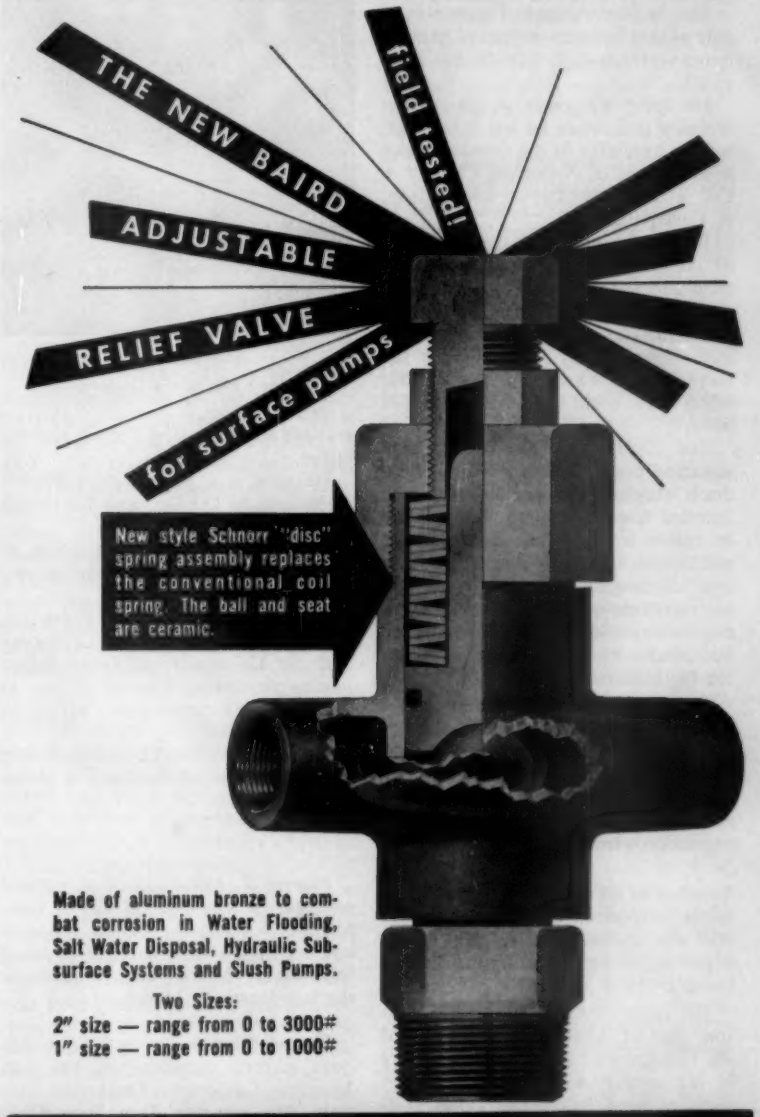
Duval County: Ralph Rowden and E. J. Pearl 4-A John T. Dinn, Section 62, J. T. Dinn Sur., A-1904, 12 miles northeast of Bruni. AOF 3,100 M.c.f.d., dry gas, shut-in TP 945 psi., perf. 3,019-29 ft. TD 6,297 ft. New reservoir discovery 1 mile northeast of Santo Nina field.

J. D. Cain Oil Co. 1-B J. T. Dinn, Section 462, S. Perez Sur., A-1687, 21 miles west of Sweden. AOF 1,980 M.c.f.d., dry gas, shut-in TP 438 psi., perf. 1,556-68 ft., Frio stringer sand. TD 1,620 ft. New pay in Dinn area.

Hidalgo County: Northern Pump Co. et al. 1 Joe Cook, Lot 2006, Section 119, North Capisallo District, Llano Grande Grant, 6 miles northeast of Weslaco. AOF 4,100 M.c.f.d., GLR 24 M.c.f. per bbl., 54°, shut-in TP 6,635 psi., perf. 10,144-150 ft., Frio. TD 10,764 ft. New field discovery.

George H. Coates and Mokeen Oil Co. 1 Longoria-Hinojosa, Share 4, Lino Hinojosa Partition, San Ramon Grant, 2 miles east of La Reforma. AOF 9,400 M.c.f.d., GLR 56.5 M.c.f. per bbl., 61.4°, shut-in TP 2,658 psi., perf. 6,923½-40 ft., Frio, and 4,700 M.c.f.d., GLR 56.7 M.c.f. per bbl., 61.3°, 2,589 psi., perf. 6,767-79½ ft., Frio. TD 8,042 ft. New pays in Rico field.

Jim Wells County: Gilcrease Oil Co. 1 Quinto Creek Gas Unit, Block 13, Dibrell, Soyars & Gallagher Subd., Casa Blanca Grant, A-296, 4 miles east of Orange Grove. AOF 1,800 M.c.f.d., GLR 10 M.c.f. per bbl., 56°, shut-in TP 1,535 psi., perf. 4,452-57 ft., Frio. TD 4,510 ft. New-field discovery in Quinto Creek area.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Texans Elect Robertson

. . . to head association. Abilene oil man will use experience in cotton industry to fight government controls.

IN SAM ROBERTSON, of Abilene, the West Central Texas Oil and Gas Association has a new president who will resist further federal oil and gas controls with all the power he can muster.

The reason is simple. Robertson has seen close hand how government controls have slowly throttled a once-flourishing business—the cotton industry.

The mild-mannered Texan was a part of that industry for many years—more years, in fact, than he has been in oil.

He spent 23 years in the cotton business and, when he left it in 1954, was an executive in the domestic sales headquarters of Anderson, Clayton & Co., a nationally known cotton firm, at Greenville, S. C.

Robertson witnessed the beginning of cotton's current frustration when crop allocations and government loan programs were initiated in the 1930's. The effects of government cotton controls weren't really felt until after the war in the 40's and 50's, he says. But when they were felt, they were felt hard.

The little fellow now has been squeezed out. There used to be hundreds of small cotton merchants who handled from 25,000 to 50,000 bales of cotton a year and netted perhaps $35,000 to $50,000 a year. "Ten years ago," Robertson says, "the small cotton merchant was a wealthy man in his community. Now he has been weeded out. And there is only room in cotton for big business."

The oil industry, Robertson thinks, appears to be on the approaches, at least, "to the same rough road cotton has already traveled." He thinks it is foolhardy and suicidal for businessmen to run to the Government for regulation whenever times are bad.

Switches to oil . . . Robertson's switch to oil from cotton wasn't really abrupt. His was an oil family. His father began an oil career during the Ranger boom in 1918 and 1919.

His older brother, French Robertson, also of Abilene, Tex., is one of the best-known independent operators in the country and served in recent years as president of the Texas Mid-Continent Oil and Gas Association.

Sam actually was in the oil business in absentia before he left the cotton industry, through investments in operations supervised by French and his father.

Sam Robertson
. . . don't run to the Government.

He now is a partner with French in Robertson Oil Co. and Robertson L.P.G. Co., both of Abilene.

He previously served a long term as vice president of the association and as a director.

Born in Haskell, Tex., Robertson attended Hardin Simmons University and the University of Texas before joining Anderson, Clayton & Co. in that firm's export-import office in Houston.

He moved to South Carolina after a long hitch with the company in Houston.

●

Marvin F. Miller, assistant general manager of Standard Oil Co. of California's Richmond, Calif., refinery, has been appointed manager of labor relations for the company. He succeeds the late Harry R. Miller.

Harold Billman, Union Oil Co., has been elected president of the San Joaquin, California, Geological Society. He succeeds **Tom Roy,** Ohio Oil Co. Other new officers are **Joseph Dunwoody,** Tidewater Oil Co., vice president, and **James Bigelow,** Western Gulf Oil Co., secretary-treasurer.

▶▶▶ Personals

Archie Miller, general manager of Duke Drilling Co., Ltd., has been elected president and general manager and a director of the company. Miller joined Duke Drilling in 1953 as superintendent.

W. J. Owens, junior exploitation engineer in Houston for Shell Oil Co., has been transferred to Corpus Christi, Tex., as exploitation engineer. **H. E. Curtis,** junior geologist in Houston, has been promoted to geologist, Corpus Christi.

William I. Patrick, executive vice president of Esso S. A. Petrolera Argentina, has been named president of the company. He succeeds **B. G. Tchalidy,** who will retire January 1 after 37 years in Argentina.

B. H. Powers, supervisor of lines for Great Lakes Pipe Line Co.'s southern area, has been named assistant southern area superintendent. **G. L. Pogson,** formerly assistant to the area superintendent, has been named southern area supervisor of lines.

New board members of North Dakota Oil and Gas Association are **Langdon G. Williams,** Phillips Petroleum Co., Billings, Mont.; **Harold L. Severson,** Signal Oil & Gas Co., Tioga, N. D.; **C. A. Dawson,** Skelly Oil Co., Bismarck, N. D.; **James Boxell,** Calvert Drilling Co., Bismarck; and **Conner Griffin,** Tennessee Gas Transmission Co., Bismarck.

Service Pipe Line Co. has made seven appointments to the Bayou Pipe Line system. Service assumes operation of the line, formerly operated by Shell Pipe Line Corp., on January 1. **Lonnie L. Collins,** Quitman, Tex., has been appointed terminal foreman in Baton Rouge, La., by Service. **Julius Hawkins,** Mexia, Tex., has been named station foreman at the Port Neches, Tex., terminal. **Hal McClintock,** Mineral Wells, Tex., has also been assigned to the Neches terminal as mechanic foreman. **Clark B. McCune,** Auburn, Mo., has been named station foreman at the Baytown, Tex., terminal. **Eugene B. McLemore,** Houston, will be office supervisor in Baytown. **James D. Parkerson,** Douglass, Tex., will be Basile, La., station foreman. He will supervise stations in Basile and Buhler, La. Also, **Waldo W. Dean,** Craig, Colo., has been named senior clerk-dispatcher in Baytown. Baytown will be operating headquarters for the system.

▶▶▶ Personals

G. W. Heid, area geologist for Shell Oil Co., has been promoted to senior geologist in Houston.

William R. Fairchild, Shell Oil Co. gas engineer, has been transferred to Midland, Tex., from New York.

James H. Gardner, Jr., Wichita independent, has joined Meadowlark Drilling, Inc., Great Bend, Kans., as exploration manager for the new Wichita division office.

Sanford D. Blattner, senior staff geophysicist for Mobil International Oil Co., has been appointed chief geophysicist for Mobil Co. Blattner has been with Socony Mobil Oil Co. and its affiliates since 1938.

Dr. Paul G. Carpenter, acting general manager of Copolymer Rubber & Chemical Corp., has been promoted to executive vice president and general manager. He succeeds the late Thomas B. Crowell. Carpenter joined Copolymer in 1956 as director of research and development.

William Priestley, Jr., acting assistant director of Esso Research & Engineering Co.'s process research division, has been named director of the company's new analytical research division. **Hollis L. Leland,** head of the analytical section, products research division, has been named assistant director of the new division.

Homer B. Rainbolt, Dallas division landman for Texaco Inc., has been promoted to chief landman in the exploration division, domestic producing department, a new position. He will headquarter in Houston. **N. M. Faulkner, Jr.,** assistant division landman, will succeed Rainbolt in Dallas. Rainbolt was assistant general manager of Seaboard Oil Co.'s domestic producing division before the Texaco-Seaboard merger.

Don M. Shields, general manager of domestic crude-oil purchases and sales for Sunray Mid-Continent Oil Co., has taken on additional duties as coordinator of crude-oil purchasing and transportation for Suntide Refining Co., new Sunray Mid-Continent subsidiary. **P. M. Broach,** vice president of Suntide, formerly handled these duties. Broach has resigned to join Cardinal Petroleum Corp., San Antonio, Tex., as vice president and general manager. **George M. Martin,** vice president and general manager of Suntide Pipe Line Co., will represent Suntide locally in the Corpus Christi, Tex., area in crude-supply transactions.

W. R. Morton, secretary and a director of Cities Service Gas Co., has retired after 50 years with the company and its affiliates.

R. L. O'Shields has joined the Ralph H. Cummins Co., Fort Worth, as a senior petroleum engineer. He replaces **Richard M. Hillyer,** formerly vice president of the company.

Jack Sessions, tool pusher with Helmerich & Payne, Inc., has been transferred to Hobbs, N. M., from Elk City, Okla.

H. O. Stallings, formerly district petroleum engineer in Shreveport, La., for Tennessee Gas & Oil Co., has joined Delhi-Taylor Oil Corp. in Dallas as reserves and evaluation engineer.

George H. Truran, administrative assistant to the production manager of Tidewater Oil Co.'s western division, has been named division production superintendent, a new position. Truran joined Tidewater in 1946. He has been San Joaquin Valley area superintendent and staff assistant to the southern division production manager.

Roe E. Withrow, Jr., formerly on special assignment on the treasurer's staff for Dow Chemical Co., has been appointed assistant to the president of Dow Chemical International, Ltd., S. A. He will be secretary of the Dow International executive committee, assistant secretary of the board, and a member of the overseas finance committee. Withrow has formerly been superintendent of Dow's ethylbenzene and styrene plant in Sarnia, Ont., and production planning engineer for ethylene and plastics products.

White Eagle International, Tulsa, and Rotary Engineering Co., Midland, Tex., will complete merger arrangements next week. Rotary Engineering will continue to operate under its present name as a subsidiary of White Eagle. **W. H. Helmerich,** president of White Eagle, will be chairman of the new White Eagle. **Olin R. Prather,** president of Rotary Engineering, will be president. **James Griffiths,** vice president, will headquarter in Midland, and **Fred Douglas,** vice president, will headquarter in South America. **Olan T. Moore** has been named vice president and secretary-treasurer of the new company. Rotary Engineering officers are Moore, president; **Roy Richardson,** vice president; and **Robert Clark,** secretary and treasurer. Principal office of White Eagle International will be moved to Midland from Tulsa.

Lewis Finch, Jr., chief engineer, producing department, for Pan American Petroleum Corp. in Tulsa, has been appointed manager of production, a new position. Finch has also been elected a director of Pan American Gas Co., a subsidiary. A graduate of Oklahoma State University, Finch joined Pan Am in 1937. He has been Fort Worth division engineer, Midland, Tex., district superintendent, and chief production engineer in Tulsa. He had been chief engineer, producing department, since 1952.

Dr. George W. Fiero, assistant manager of the lubricants and wax division of Esso Standard Oil Co.'s petroleum specialties department, has been elected president of the Chemical Specialties Manufacturers Association.

Joseph H. Lang, vice president in charge of transmission for Ohio Fuel Gas Co., will retire January 1. Lang joined the company in 1914. He was named vice president and transmission manager last year.

Allen Myra, assistant general manager of N.V. Standard-Vacuum Petroleum, Mij., Indonesian subsidiary of Standard-Vacuum Oil Co., has been appointed general manager. He succeeds **Bruno O. Winkler,** who will be reassigned by the parent company. Myra had been managing director of Standard-Vacuum Refining Co. of India, Ltd., and general superintendent of Stanvac's Bombay, India, refinery before moving to the Indonesian company in 1957.

Jersey Production Research Co. has reorganized its production division into three sections instead of four. **A. G. Weber,** now section head in reservoir engineering, will be head of the primary recovery section. **C. D. Russell,** head of the reservoir research section will be head of the new secondary recovery section. **G. G. Binder,** recovery research section head, will be in charge of the new methods section. **R. C. West,** presently section head in recovery engineering, has been named engineering associate. The appointments are effective January 1. Also, **J. R. Kyte,** formerly group head, has been named research associate for the company.

▶▶▶ Personals

C. M. Kittrell, manager of the New York office of Phillips Petroleum Co.'s supply and transportation department, has been promoted to vice chairman of the operating committee, Bartlesville, Okla. He succeeds **W. L. Phillips,** who was recently named manager of operations for Phillips' new international department. **John E. Donnelly,** assistant manager of the transportation division in Bartlesville, will succeed Kittrell in New York. Kittrell has been with Phillips since 1950.

C. M. KITTRELL

W. Monte Taylor, Jr., senior engineer with Carter Oil Co., has been transferred to Carmi, Ill., from Great Bend, Kans.

R. C. Frederick, senior vice president of Texas Natural Gasoline Corp., has been elected a director of the company.

Louis Oleari, formerly district sales manager in Houston for Oronite Chemical Co., subsidiary of Standard Oil Co. of California, has been named assistant manager of the Latin America-Asia division of California Chemical International, another California Standard subsidiary. He will headquarter in San Francisco.

Bryan C. Edwards, Canadian division gas superintendent for Pan American Petroleum Corp. in Calgary, has been named assistant manager of gas sales for the company. He will headquarter in Tulsa.

Robert Waddell, Tennessee Gas Transmission Co., has been elected president of the Gulf Coast Oil Scouts Association. He succeeds **Charlie Pence,** Humble Oil & Refining Co. Pence has been named area representative to the International Oil Scouts Association board of directors. Other officers of the Gulf Coast group include **Walter Holly,** Lion Oil division of Monsanto Chemical Co., first vice president; **Henry Boehm,** Phillips Petroleum Co., second vice president; and **Bill Miller,** Superior Oil Co., secretary-treasurer. Executive committee members are **Dean Guy,** Tidewater Oil Co.; **Phil Moss,** Trunkline Gas Co.; **Robert Mize,** Texaco Inc.; and **John Wilson,** Ohio Oil Co.

Jack C. McKendry, distribution manager of Michigan Farmers Petroleum Co-op, has been promoted to manager of the company. He succeeds **Earl Huntley,** who has resigned.

Claude A. Lamb, district foreman in charge of maintenance and construction for Tidewater Oil Co. pipeline facilities in the Los Angeles Basin area, has retired after 36 years with the company.

John R. Stroder, senior chemist in Hobbs, N. M., for Northern Natural Gas Co., has been promoted to process engineer and transferred to Omaha. Stroder joined the company in 1958.

William F. Maule, Houston, has been named engineer-geologist for the Arizona Oil and Gas Conservation Commission. A graduate of the University of Oklahoma, Maule has formerly been with Halliburton Oil Well Cementing Co., B&J Well Service, Inc.; and Moroil, Inc., of Houston.

Philip C. Holladay, Joe L. Young, and **Gary E. Smith,** chemists with Shell Chemical Corp., have been transferred to Union, N. J., from Houston. Also moving to the Union technical service laboratory from Houston are **Ronald E. Carlson,** industrial engineer; **Dieter H. von Hennig, Louis B. Sullivan, Larry D. Siemers, William C. Bowman,** and **Peter J. Vasiliadis,** marketing trainees.

Glenn P. Thompson, Tennessee Gas Pipeline Co., has been elected 1960 president of Gulf States chapter No. 8, American Right of Way Association. He succeeds **W. B. Thornton,** Houston Lighting & Power Co. Other officers are **William H. Huffman,** Humble Pipe Line Co., secretary, and **C. E. Patton,** Houston Lighting & Power, treasurer. New vice presidents include **Dan Williamson,** Transcontinental Gas Pipe Line Corp.; **J. M. DeBardeleben,** Bureau of Public Roads; **Kenneth E. Moreland,** El Paso Natural Gas Co.; **T. E. O'Neill,** Shell Pipe Line Corp.; and **L. V. Dennis,** Interstate Oil Pipe Line Co.

I. G. Morgan, general sales manager of the Pacific Coast region for Texaco Inc., has been elected vice president in charge of domestic sales. He will headquarter in New York. Morgan has been with Texaco since 1931. He was Dallas sales division manager before moving to Los Angeles in 1953 as assistant general sales manager. He became general manager of sales in the Pacific Coast region earlier this year.

Robert W. Campbell, general manager of Home Oil Co., Ltd., has been named vice president and a director.

L. T. Frazier, tool pusher with Phoenix Drilling Co., has been transferred to Carrizo Springs, Tex., from Dumas, Tex.

Glenn Brant has been named general manager of Devon-Palmer Oils, Ltd., in Calgary. **Douglas White** has been named assistant general manager.

Joe Wanenmacher, Jr., production engineer with Sinclair Oil & Gas Co., has been transferred to Pampa, Tex., from Gainesville, Tex.

A. J. Head, manager of manufacturing divisions for Phillips Chemical Co., has been promoted to manager of the company. A graduate of the University of Oklahoma, Head joined Phillips in 1937. He was superintendent of the company's Borger, Tex., plant before being named manager of manufacturing divisions in 1957.

Arthur A. Curtice will resign January 31 as president and general manager of Signal Oil & Gas of Venezuela to open consulting offices in New York. Curtice has been president of the Venezuelan company since 1957. He was a technical advisor and negotiator in the preparation of Venezuela's present petroleum law during the 1940's. Curtice was at that time head of the firm of Hoover, Curtice, & Ruby, S. A. He is a graduate of Stanford University.

Fred Armstrong, assistant chief engineer of Plantation Pipe Line Co., has retired. Armstrong joined the company in 1942 during construction of the system.

R. C. Knect, Baton Rouge, La., district geologist for Shell Oil Co., has been promoted to southeast division exploration manager. **Harry Fisher,** Baton Rouge division land manager, will become southeast division land manager. Knect and Fisher will move to New Orleans from Baton Rouge when two new Shell buildings are completed there next summer. Shell's Baton Rouge division, Donaldsonville, La., production division office, area production laboratory in New Orleans, and Westwego, La., production division office, will headquarter in the new buildings.

James F. Nowlin, chemical engineer with Petro-Tex Chemical Corp. in Houston, has been transferred to the sales department as development engineer.

J. R. Pfitzer, mechanical engineer in Great Lakes Pipe Line Co.'s general office, has been promoted to chief mechanical engineer.

C. E. Wright, vice president of Signal Drilling & Exploration, Inc., will move to Denver, now headquarters of the company, from Tulsa.

John F. Harris, staff geologist with Pan American Petroleum Corp., has resigned to open consulting offices in Tulsa.

Pete W. Cawthon, Jr., First City National Bank, Houston, has been elected 1960 chairman of the Gulf Coast section of AIME's Society of Petroleum Engineers. He succeeds **W. Scott Kraemer,** Pan American Petroleum Corp., who has been named a director. Other new officers include **W. M. McCardell,** Humble Oil & Refining Co., vice chairman; **Jack McWilliams,** Pan American, secretary-treasurer; and **E. A. Rassinier,** Trunkline Gas Co., delegate to the national society. New directors are **J. Don Clark,** Union Oil Co.; **W. J. Greenwald,** Humble; **C. M. Hinton,** Oil Reserves Corp.; and **Gene L. Scheirman,** Shell Oil Co.

P. A. MacQueen, reservoir engineer for Shell Oil Co., has been transferred to the New Orleans area from Houston.

Frank P. DeMasi, field engineer for Ohio Oil Co. in Bradley, Okla., has been transferred from engineering to the domestic purchasing department as assistant buyer. He will headquarter in Findlay, Ohio.

R. P. Ryan, eastern division manager in Mattoon, Ill., for Carter Oil Co., has been named general counsel and a director of the company. He will headquarter in Tulsa. Ryan succeeds **Forrest M. Darrough,** who recently was named associate general counsel of the new Humble Oil & Refining Co. Also, **Thomas Brownfield,** Carter vice president, has succeeded Darrough as president of McKamie Gas Cleaning Co., Magnolia, Ark. **W. F. Eiting, Jr.,** and **A. L. Deaton** of Carter have been elected directors of McKamie. Deaton, assistant general counsel for Carter since 1955, has been promoted to associate general counsel.

▶▶▶ Personals

R. M. Nugent, chief geophysicist and staff advisor to the exploration manager of Mobil Oil Co. in New York, has joined Cosden Petroleum Corp. as assistant to the president. He will headquarter in Big Spring, Tex. Nugent was area geophysicist in Dallas for Magnolia Petroleum Co. before the recent merger of Magnolia and Mobil. He had been with Magnolia 22 years.

Ken H. Ault, formerly with Forest Oil Corp., has joined Trunkline Gas Co., Houston, as district production engineer in Lafayette, La.

Fred A. Davies, retired chairman and chief executive officer of Arabian American Oil Co., has been elected a director of Kern County Land Co. Davies' election brings Kern County board membership to 14. Davies retired earlier this year after 40 years with Standard Oil Co. of California and its affiliates.

▶▶▶ Deaths

Dr. John V. Starr, 57, manager of products planning in Esso Standard Oil Co.'s petroleum specialties department, died December 6 at his Cranford, N. J., home after an illness of several months. Starr had been with Esso in Linden, N. J., and New York for 31 years.

Samuel Young Ramage, III, 50, Seneca, Pa., president of Ramage Oil Co., died December 6 after a heart attack at his home.

William Henry Harris, 83, founder of Ogden Gasoline & Oil Co., Ogden, Utah, died November 28. Harris became a director of Utah Oil Refining Co. when that company purchased Ogden Gasoline in 1929. He was general manager of Utah Oil's Ogden division for several years.

William E. Conner, 72, retired Shell Oil Co. driller, died November 30 in a Bakersfield, Calif., hospital.

George D. Meier, 60, owner of Meier Rig & Construction Co., Houston, and of an affiliated Venezuelan rig construction company, died December 6 in a Houston hospital. Meier founded his company in Houston in 1937. He entered the oil business as a roughneck in Oklahoma fields.

Joseph Stone Bleakie, 51, chief estimator of the petrochemical division of Tellepsen Construction Co., died December 6 in Houston after a heart attack at his home. He had been with Tellepsen since 1946.

Clyde H. Bryner, 77, Pleasantville, Pa., independent producer, died December 7 at his home.

Charles C. Kenney, 51, assistant to the executive vice president of Ohio Oil Co., died December 6 of coronary thrombosis. Kenney had been with Ohio since 1933. He had served as manager of refining, marketing, and corporate accounting and assistant to the financial vice president.

Quinton Peters, 40, assistant manager of public relations for Sunray Mid-Continent Oil Co., died December 9 in a Tulsa hospital of cancer.

Ray H. Calder, 74, retired engineer for Union Oil Co., died December 3 in a Bakersfield, Calif., hospital.

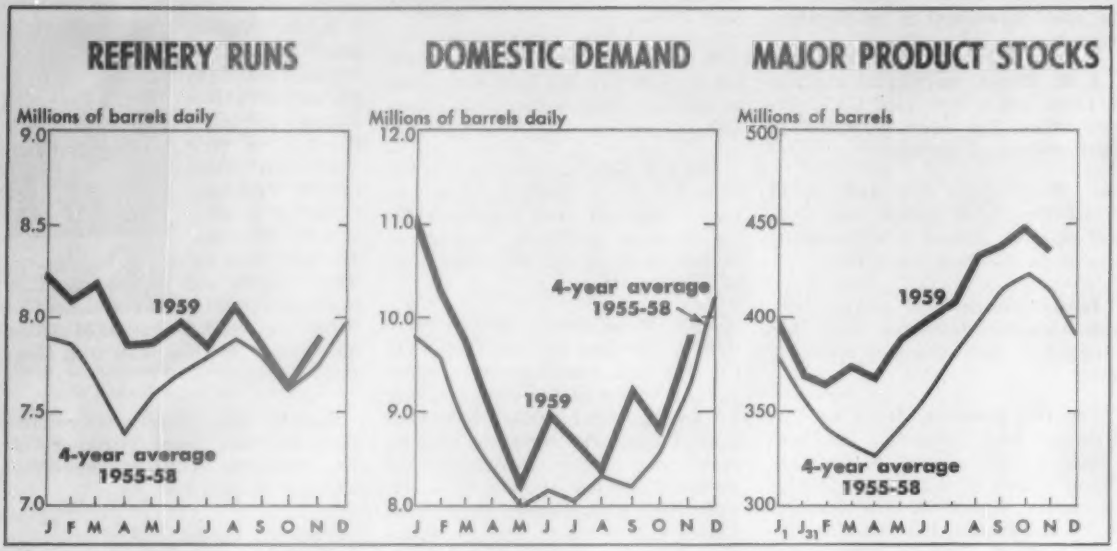
T. J. (Jack) Beddingfield, 64, executive assistant to the chairman of Sinclair Oil Corp., died December 4 in New York after a heart attack. Beddingfield had been with Sinclair since 1919.

Robert O'Donovan Mannix, 68, retired district manager of tubular sales for Continental-Emsco Supply Co., died December 3 in a Tulsa hospital. He had been ill for several months. Mannix was with Continental-Emsco for 35 years before his retirement in 1957.

T. Jeff Archer, 59, Tulsa independent geologist, died December 3 in a Tulsa hospital. He had been ill for several weeks.

Jay Hausam, 67, retired Danciger Oil & Refining Co. official, died December 2 in a Fort Worth hospital of cancer. Hausam retired in 1958. He was purchasing agent, head of the land department, and Tulsa office manager for the company at one time.

John W. McClurg, 63, Tri-State oil producer, died December 2 in an Evansville, Ind., hospital.



Oil figures show a most unusual year

BY JOHN C. CASPER

THERE has been neither rhyme nor reason in petroleum statistics this year. Refinery operations followed normal trends for some months but went counter to trends in others. At times, major product stocks were out of line by as much as 30,000,000 bbl., and monthly demand totals failed to follow normal patterns.

Some of these variations are shown in the charts at the top of the page. In each case the light line shows a trend indicated by a 4-year average for the period 1955-58. These cannot be classified as model years, but they do show something of recent industry trends.

Take a look at the picture of refinery runs. First, refiners never have followed the seasonal pattern of demand. For the past 25 years, there has been an increasingly sharp dip in demand during the summer months, but refiners have not met this drop in demand with a corresponding reduction in runs.

Refinery runs normally reach the low point of the year in April. It comes after the end of the big demand season, and many refiners in the past have used the slack period for inspection and repair of process units. Also, in past years there has been a tendency to overbuild inventories during the summer months. Full storage has forced reductions in runs during September and October.

It is normal for refinery runs to start dropping in March and continue through April. This year there was an increase in March. Also, notice on the chart that, except for the decrease in July which was balanced by the gain in August, refinery runs remained at a near-constant level from April through September. Runs varied about as much by months as they did by seasons.

Calculated demand has been erratic this year. January domestic demand was almost 1.2 million barrels daily above the 4-year average for 1955-58. For August the difference was only 154,000 bbl. daily. Other extreme increases were reported for June and September. Gains were very small in May and October.

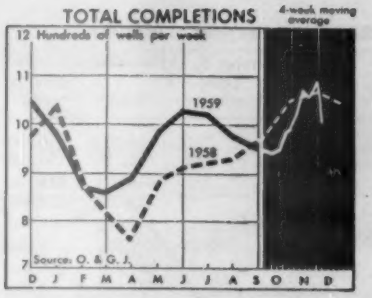
Part of the drop in demand for August can be credited to the steel strike, but the strike continued through September, a very high month. The big drop in August distillate demand points to a failure of jobbers to fill their tanks in August. They waited until September to start buying.

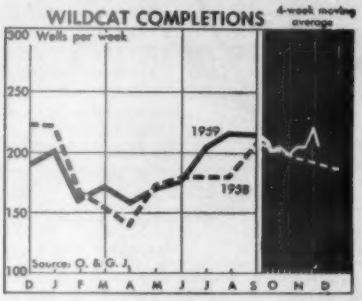
These shifts in demand and refining have produced unusual stock-change patterns. Note the small decrease in February, the abnormal increase in March, and the big gain in August.

The four-product stock total is running a little ahead of last year, and refiners do not need to plan for a December demand increase as big as the one last year. That was a record gain of 2,248,000 bbl. daily.

A quick look at the highlights

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	7,067,410	UP	88,200	DOWN	25,890
Crude stocks	252,665,000	UP	192,000	DOWN	5,633,000
Completions	758	DOWN	396	DOWN	231
Refinery runs	7,983,000	UP	10,000	UP	317,000
Gasoline stocks	181,406,000	UP	2,227,000	UP	7,101,000
Kerosine stocks	30,351,000	DOWN	1,341,000	DOWN	658,000
Distillate stocks	164,093,000	DOWN	6,793,000	UP	8,267,000
Residual stocks	53,898,000	DOWN	2,291,000	DOWN	11,239,000
Four-product stocks	429,748,000	DOWN	8,198,000	UP	3,471,000
Total imports	1,840,500	UP	46,500	UP	114,100





Active Rotary Rigs

	12-7-59	11-30-59	12-8-58
Alabama	6	6	13
Arkansas	14	15	23
Arizona	0	0	1
California	90	95	95
Land	84	90	(*)
Offshore	6	5	(*)
Colorado	43	53	33
Florida	2	1	1
Land	2	1	1
Offshore	0	0	0
Illinois	42	42	47
Indiana	9	7	5
Iowa	0	0	3
Kansas	165	157	160
Kentucky	8	8	8
Louisiana	315	330	336
North	45	46	40
S. Inland waters	114	127	149
S. Land	99	102	108
Offshore	57	55	39
Maryland	0	0	1
Michigan	29	23	13
Mississippi	81	81	61
Missouri	1	1	2
Montana	23	21	29
Nebraska	28	27	22
Nevada	0	0	0
New Mexico	128	128	108
New York	0	0	1
North Dakota	24	28	35
Ohio	2	0	5
Oklahoma	247	253	268
Oregon	0	0	0
Pennsylvania	14	13	11
South Dakota	6	5	0
Texas	782	800	868
S. Inland waters	3	5	8
S. Land	193	192	191
Offshore	3	2	2
North-East	206	200	182
West Central	243	255	308
West	134	146	177
Utah	31	34	37
Washington	1	1	0
West Virginia	4	4	2
Wyoming	72	80	86
Total U. S.	2,167	2,213	2,274
Western Canada	198	193	182
Eastern Canada	1	1	1
Grand total	2,366	2,407	2,457

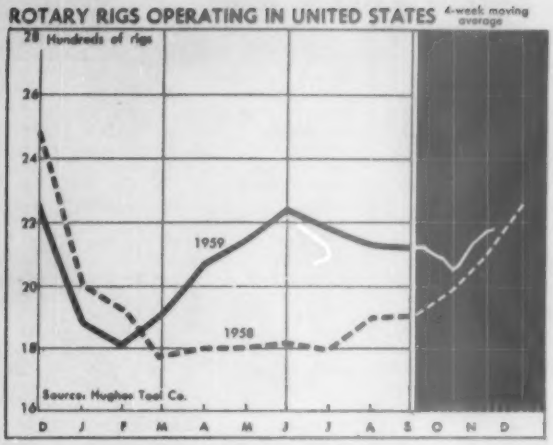
Hughes Tool Co. report. *Comparisons not available due to change in method of reporting.

WEEKLY WELL COMPLETIONS . . . WEEK ENDED DECEMBER 5, 1959

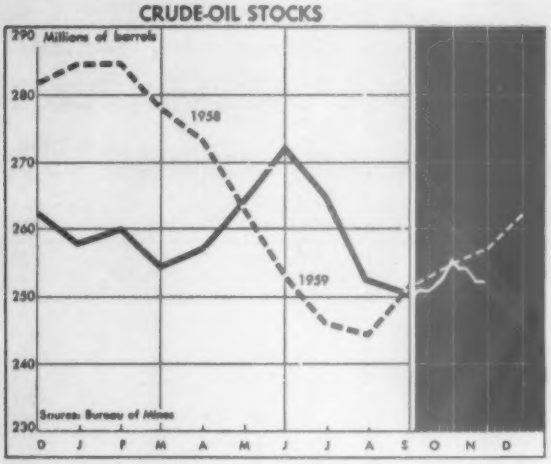
	Total wells							Cum.		Total wildcats					Cum.	
	Total	Crude	Cond.	Gas	Dry	Service	Footage	1959	1958	Total	Crude	Cond.	Gas	Dry	1959	1958
Alabama	1	0	0	0	1	0	3,910	85	70	1	0	0	0	1	22	26
Arizona	0	0	0	0	0	0	0	25	.....	0	0	0	0	0	23	.....
Arkansas	19	13	0	0	6	0	60,303	780	751	6	3	0	0	3	141	152
California	36	15	0	1	17	3	175,621	1,433	1,402	16	1	0	0	15	381	345
Colorado	20	3	0	5	12	0	94,365	722	794	8	0	0	0	8	409	458
Illinois	52	12	0	0	13	27	97,722	2,193	2,256	4	2	0	0	2	365	431
Indiana	17	5	0	0	12	0	25,000	802	815	8	1	0	0	7	273	293
Kansas	90	43	0	2	42	3	310,029	3,707	3,770	24	1	0	1	22	987	791
Kentucky	133	110	0	5	18	0	105,915	2,929	1,737	11	0	0	0	11	346	164
Louisiana	72	32	12	4	24	0	518,305	3,516	3,266	9	0	1	0	8	472	482
North	28	14	0	3	11	0	94,403	1,396	1,280	6	0	0	0	6	215	218
South	37	13	11	1	12	0	361,298	1,739	1,594	3	0	1	0	2	242	240
Offshore	7	5	1	0	1	0	62,604	381	392	0	0	0	0	0	15	24
Michigan	9	1	0	1	7	0	31,430	609	403	6	0	0	0	6	172	133
Mississippi	14	6	0	0	8	0	117,125	595	377	7	0	0	0	7	263	163
Montana	6	2	0	0	4	0	28,033	319	312	6	2	0	0	4	115	124
Nebraska	17	9	0	0	8	0	94,364	836	687	7	3	0	0	4	363	327
New Mexico	36	18	1	11	6	0	685,243	1,949	1,811	6	2	0	0	4	230	246
West	16	4	1	11	0	0	71,616	863	890	0	0	0	0	0	60	94
East	20	14	0	0	6	0	95,322	1,086	921	6	2	0	0	4	170	152
New York	19	12	0	0	0	7	24,572	256	501	0	0	0	0	0	19	44
North Dakota	8	5	0	0	3	0	50,379	410	422	3	1	0	0	2	77	129
Ohio	20	6	0	5	9	0	37,324	1,013	969	1	0	0	1	0	31	17
Oklahoma	45	33	0	2	10	0	121,012	5,090	5,908	0	0	0	0	0	779	805
Pennsylvania	0	0	0	0	0	0	0	523	573	0	0	0	0	0	19	21
South Dakota	0	0	0	0	0	0	0	20	.....	0	0	0	0	0	9	.....
Texas	86	30	8	5	43	0	439,916	17,119	16,805	28	1	0	0	27	3,237	3,372
District 1	15	7	0	0	8	0	39,198	1,008	922	7	1	0	0	6	309	346
District 2	18	3	1	3	11	0	95,846	753	687	6	0	0	0	6	219	180
District 3	13	4	2	0	7	0	93,075	1,101	1,191	3	0	0	0	3	218	268
District 4	20	8	2	2	8	0	103,422	1,247	1,064	6	0	0	0	6	311	319
East	20	8	3	0	9	0	108,375	1,169	1,129	6	0	0	0	6	230	304
District 7-B		(Figures not available)						2,382	2,359	....	....	....	....	....	629	646
West		"	"	"	"			5,105	4,795	....	....	....	....	....	692	653
District 9		"	"	"	"			3,185	3,451	....	....	....	....	....	529	539
District 10		"	"	"	"			1,169	1,243	....	....	....	....	....	100	117
Utah	4	2	0	1	1	0	18,893	288	361	2	0	0	1	1	88	77
West Virginia	25	4	0	17	4	0	64,350	735	724	0	0	0	0	0	27	18
Wyoming	23	6	0	2	15	0	114,134	901	702	8	0	0	0	8	328	238
Misc. (Alaska)	6	4	0	0	2	0	71,223	90	90	0	0	0	0	0	57	80
Total U. S.	758	371	21	61	265	40	3,289,168	46,945	45,506	161	17	1	3	140	9,233	8,936
Prev. week	1,154	592	33	65	454	10	4,571,078	.....	.....	231	15	2	8	206	.....	.....
Cum. 1959	46,945	23,430	1,150	3,465	17,589	1,311	193,425,261	.....	.....	9,233	822	101	304	8,006	.....	.....
Cum. 1958	45,506	22,381	1,042	3,437	17,377	1,269	184,143,173	.....	.....	8,936	855	142	248	7,691	.....	.....
Western Canada	48	28	0	4	15	1	234,183	2,244	2,308	14	0	0	2	12	618	607

PRODUCTION

ROTARY RIGS OPERATING IN UNITED STATES



CRUDE-OIL STOCKS



CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

	11-28-59	11-21-59	11-29-58
Pennsylvania	2,511	2,516	2,811
Other Appalachian	2,097	1,969	1,678
Illinois, Indiana, Michigan	10,010	10,224	10,472
Nebraska and North Dakota	3,096	3,190	2,416
Kansas	9,626	9,605	10,412
Oklahoma	14,822	14,896	17,492
Arkansas	2,028	2,207	2,283
Louisiana	18,560	17,724	17,351
North	3,233	3,157	2,963
South	15,327	14,567	14,388
Mississippi, Alabama, Florida	2,181	2,028	2,591
New Mexico	8,120	8,159	8,169
Texas	111,526	111,377	112,956
East Texas	8,136	8,610	8,053
West Texas	52,485	52,400	54,548
Texas Gulf	20,014	19,597	19,958
Other Texas	30,891	30,770	30,397
Wyoming	17,040	17,176	14,066
Other Rocky Mountain	8,916	9,239	8,967
California	28,942	28,983	32,540
Foreign	†13,190	13,180	14,094
Total	252,668	252,473	258,298

*Bureau of Mines. †Includes 4,532,000 bbl. in California.

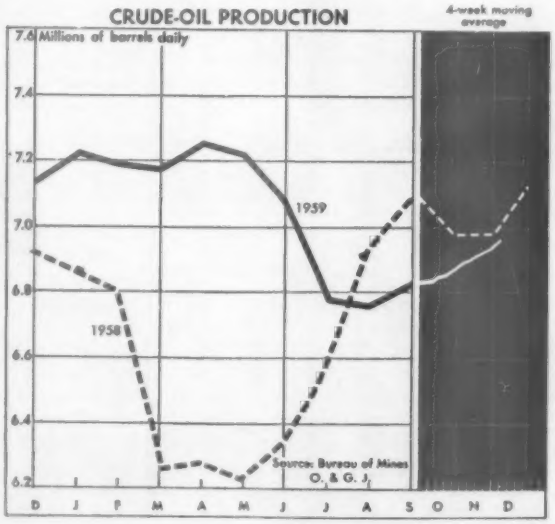
DAILY AVERAGE PRODUCTION FOR WEEK

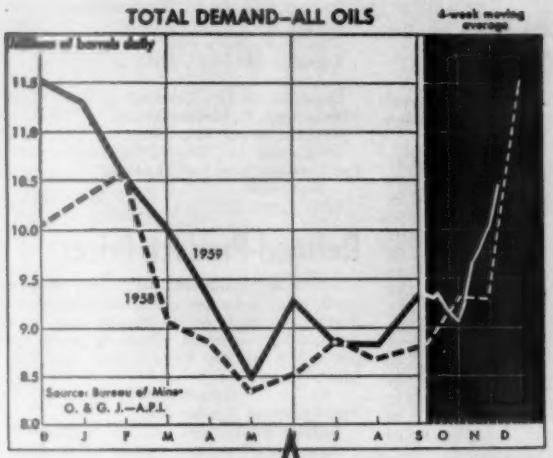
	December 5, 1959 Crude oil	Lease condensate	Total	Nov. 28 total
Alabama	16,000	.....	16,000	16,300
Arkansas	82,500	270	82,770	70,880
California	836,000	.....	836,800	838,100
Colorado	128,000	.....	128,000	126,800
Eastern	42,000	.....	42,000	40,700
Florida	1,170	.....	1,170	1,170
Illinois	215,800	.....	215,800	217,800
Indiana	31,500	.....	31,500	31,700
Kansas	†322,040	.....	†322,040	†332,500
Kentucky	78,600	.....	78,600	77,900
Louisiana	926,620	107,000	1,033,620	1,039,550
North	108,200	5,800	114,000	114,050
South	818,420	101,200	919,620	925,500
Michigan	33,400	.....	33,400	32,200
Mississippi	140,700	5,050	145,750	144,150
Montana	82,000	.....	82,000	82,500
Nebraska	63,800	.....	63,800	64,500
Nevada	100	.....	100	100
New Mexico	289,180	6,500	295,680	294,150
North Dakota	52,300	.....	52,300	51,800
Oklahoma	†548,600	.....	†548,600	†547,300
Texas	2,513,270	81,200	2,594,470	2,523,200
Dist. 1	43,000	3,000	46,000	45,800
Dist. 2	107,430	8,800	116,230	112,400
Dist. 3	327,120	38,000	365,120	356,000
Dist. 4	176,150	9,800	185,950	180,600
Dist. 5	25,580	400	25,980	25,400
Dist. 6	104,850	9,500	114,350	111,500
East Texas field	137,570	.....	137,570	133,000
Dist. 7-B	127,150	180	127,330	126,180
Dist. 7-C	122,000	3,320	125,320	121,320
Dist. 8	1,032,000	5,000	1,037,000	1,001,000
Dist. 9	203,270	2,200	205,470	203,000
Dist. 10	107,150	1,000	108,150	107,000
Utah	120,600	.....	120,600	104,500
Wyoming	342,000	.....	342,000	341,000
Others	‡410	.....	‡410	‡410
Total U. S.	6,867,390	200,020	7,067,410	6,979,210
Change from prev. week, up			88,200	.....
Canada	†494,000	.....	†494,000	†517,000

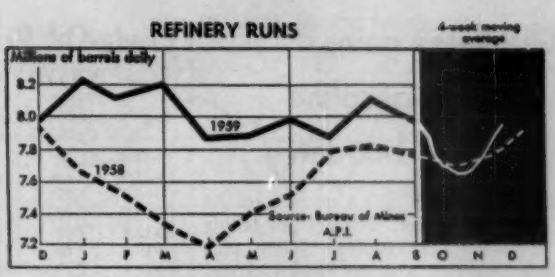
Total U. S. prod., Jan. 1-Dec. 5 ..... 2,384,088,060 bbl.
Same period last year (crude plus cond.) .... *2,263,193,670 bbl.

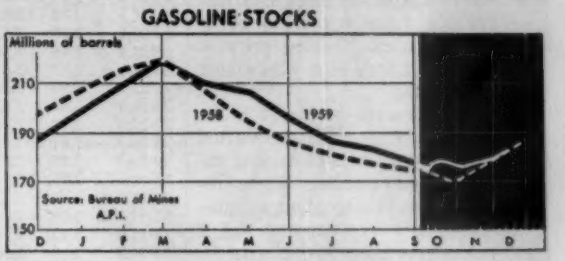
*Includes 53,949,280 bbl. condensate. †Week ended previous Monday. ‡Arizona, South Dakota and Washington.

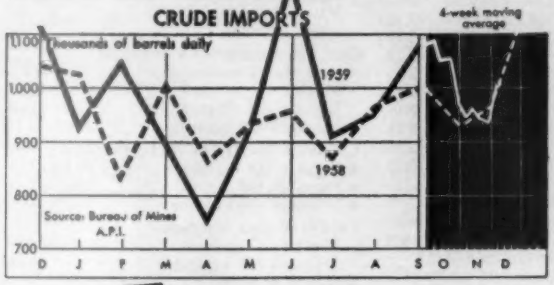
CRUDE-OIL PRODUCTION

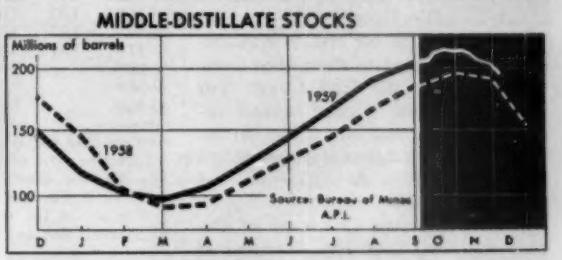


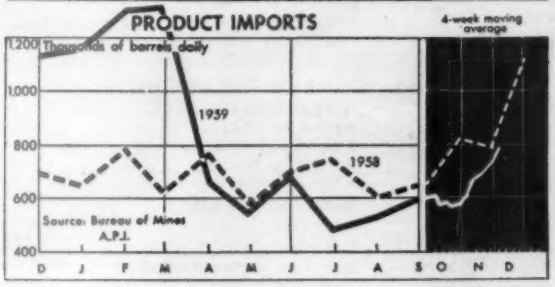


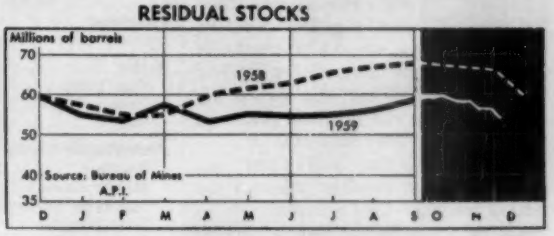












API REFINERY REPORT—DECEMBER 4, 1959

(Thousands of barrels)

District—	Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.	Stocks‡ Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, December 1958 Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.
East Coast	1,120	523.3	37.4	367.0	155.3	40,264	13,466	64,821	11,343	1,149	575.7	36.4	383.1	213.1
Appalachian:														
District 1 ...	104	44.7	4.1	20.3	14.4	5,672	717	4,690	344	102	42.6	5.8	20.3	12.1
District 2 ...	108	36.7	6.6	21.7	16.3	2,767	501	1,775	456	102	51.5	5.0	21.1	16.1
Ind., Ill., Ky. ..	1,423	799.4	84.4	326.3	196.3	30,132	6,448	25,334	5,535	1,450	738.1	70.7	335.8	205.7
Minn., Wis., Dak.	115	54.1	8.1	29.0	14.4	7,326	1,306	6,747	678	109	53.8	5.5	29.5	14.0
Okla., Kans., Mo.	675	366.3	11.6	176.6	23.7	17,525	1,469	11,164	1,052	761	427.8	17.7	203.7	37.7
Inland Texas ..	276	211.6	9.6	47.3	24.1	6,687	530	1,944	2,342	286	216.2	7.5	46.1	25.2
Texas Gulf Coast	1,896	989.0	128.4	466.4	144.2	23,345	2,727	21,062	5,322	1,864	960.1	128.4	506.8	184.3
La. Gulf Coast..	670	350.3	71.2	156.7	47.3	9,913	1,859	7,540	1,153	665	372.8	82.9	139.3	57.2
N. La. and Ark.	102	34.7	3.4	23.7	7.0									
Rocky Mountain:						5,330	637	2,489	231	95	48.3	4.8	22.6	6.0
New Mexico .	32	15.6	0	4.8	2.4	844	26	237	49	25	12.8	0.7	4.2	2.4
Other R'cky Mt.	295	135.3	3.0	67.6	37.4	4,992	266	2,481	1,163	268	130.1	3.0	64.8	35.0
West Coast ...	1,167	549.3	3.6	173.7	276.2	26,609	399	13,809	24,230	1,085	515.8	5.6	177.4	295.9
Dec. 4, 1959	7,983	4,110.3	371.4	1,881.1	959.0	181,406	30,351	164,093	53,898	7,961	4,145.6	374.0	1,954.7	1,104.7
Nov. 27, 1959	7,973	4,136.7	333.3	1,843.4	1,005.7	179,179	31,692	170,886	56,189	.....	.....	.....	.....	.....
Dec. 5, 1959	7,666	4,020.9	317.3	1,802.9	958.9	174,305	31,009	155,826	65,137	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

Distillates gain; Group 3 gasoline price hits bottom

DISTILLATE FUELS are firm on the Group 3 market. Jobbers are taking No. 2 at 9.25 cents a gallon plus transportation with no reports of discounting. No. 1 fuel borders on being scarce in the area. Quoted price is 10.00 cents, but very little is available for open trading.

The near shortage of No. 1 is related to the large military jet-fuel contracts awarded Mid-Continent refiners in recent months. Some refiners have been able to cover requirements for No. 1 by swapping No. 2 for No. 1. But even No. 2 may be a little short in District 2.

Increased calls for No. 1 in north-central areas tend to strengthen kerosine prices on the Gulf Coast. For many years, the normal spread between kerosine and No. 2 fuel on the Gulf Coast was 1.0 cent a gallon, but since 1954 the price differential has averaged about 0.5 cent.

However, in the first week of December, one 50,000-bbl. shipment of kerosine up the Mississippi River brought 0.25 cent a gallon over the Gulf Coast low, or 8.875 cents. If there is enough demand for upriver shipment of kerosine, the spread between kerosine and distillate prices on the Gulf Coast may increase.

Refiners on the Gulf Coast are expecting better distillate sales for the next 2 months. One recent survey in the area found no refiner willing to sell at a flat price for delivery for the remainder of the season. The sellers think there is at least a chance that prices will advance before the end of January. It would take a definite shortage to boost prices in February.

The same survey found that only three suppliers were willing to sell at the low as of date of lifting. The others were not certain they would have material to move on the spot market over the winter.

Some marketers believe Group 3 gasoline has hit bottom. One purchase by a refiner was reported to have been at 10 cents a gallon. One large jobber on the pipeline was buying at about the same price for a short time, but the current low on the spot market is probably about 10.25 cents. If the jobber was able to buy at 10.00 cents, he was getting regular gasoline at the same price he was paying for No. 1 fuel.

Crude-Oil Prices

GRAVITY SCHEDULE

	Signal Hill§ Calif.	Okla-homa	Gulf Coast Tex.*	West Tex.† N.M.	Wyo. (sour)
14-14.9	$1.76	....	....	....	....
15-15.9	1.84	....	....	....	$1.81
16-16.9	1.92	....	....	....	1.86
17-17.9	2.00	....	....	....	1.91
18-18.9	2.08	....	....	....	1.96
19-19.9	2.16	....	....	....	2.01
20-20.9	2.24	$2.49	....	$2.35	2.06
21-21.9	2.32	2.52	....	2.38	2.11
22-22.9	2.39	2.55	....	2.41	2.16
23-23.9	2.46	2.58	$3.44	2.44	2.21
24-24.9	2.53	2.61	3.46	2.47	2.26
25-25.9	2.60	2.64	3.48	2.50	2.31
26-26.9	2.67	2.67	3.50	2.53	2.36
27-27.9	2.74	2.70	3.52	2.56	2.49
28-28.9	2.81	2.73	3.54	2.59	2.54
29-29.9	2.87	2.76	3.56	2.62	2.59
30-30.9	2.93	2.79	....	2.65	2.63
31-31.9	3.00	2.82	....	2.68	2.67
32-32.9	3.06	2.85	....	2.71	2.71
33-33.9	3.12	2.88	....	2.74	2.75
34-34.9	3.17	2.91	....	2.77	2.79
35-35.9	3.22	2.94	....	2.80	2.83
36-36.9	3.27	2.97	....	2.83	2.87
37-37.9	3.31	2.99	....	2.86	2.89
38-38.9	....	3.01	....	2.89	2.91
39-39.9	....	3.03	....	2.92	2.93
40-40.9	....	3.05	....	2.95	2.95

*Low cold test crude. †Sour.

Effective dates of broad changes: California, 9-11-59; East of California, January 3-10, 1957; Pennsylvania Grade 9-12-59.

§Union Oil Co. of California posting up to 25 cents less per barrel.

FLAT PRICES

Louisiana:	
Sweet Lake	$3.00
Texas:	
East Texas	3.05-3.25
Conroe	3.23-3.53
Van	3.08
Pennsylvania Grade:	
Bradford	4.40
Middle District	4.22
Southwest Pennsylvania	3.95
West Virginia	3.77
Buckeye Grade	3.62
Illinois Basin	**3.00**

FOREIGN

Canada:	
Leduc-Woodbend	2.53
Redwater (Alta.)	2.42
Smiley (Sask.)	2.18
Pembina	2.38
Venezuela:	
Cumarebo, 48°-49.9°, Tucupido	3.34
San Joaquin, 41°-41.9°, Puerto La Cruz	3.08-3.10
Oficina, 35°-35.9°, Puerto La Cruz	2.80
Tia Juana medium, 26°-26.9°, Amuay*	2.30
Quiriquire, 16.0°-16.4°, Caripito	2.10
Lagunillas heavy, flat, Las Piedras*	2.10
Bachaquero, flat, 15°-16°, Las Piedras*	1.88

Prices for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° vary 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

Middle East, Persian Gulf (cargoes f.o.b. lifting port):	
Arabian, about 34°, Ras Tanura	$1.89
Iranian, 34.0°-34.9°, Bandar Masur	1.80
Iranian, 34.0°-34.9°, Abadan	1.81
Iraq, 36.0°-36.9°, Fao	1.82
Kuwait, 31.0°-31.9°, Mina-al-Ahmadi	1.67
Qatar, about 41°, Um Said	2.05
Middle East, E. Mediterranean:	
Arabian, about 35°, Sidon	2.29
Iraq, about 35°, Tripoli, Banias	2.29
Far East (cargoes, f.o.b. Lutong, Sarawak):	
Seria Light, 37°	2.57

Refined-Product Prices

Following quotations are for refinery products in cents per gallon moving in interstate shipments on Wednesday each week unless otherwise noted. Crude-oil prices are per barrel at the wells unless otherwise listed.

GASOLINE*

Mid-Continent (Group 3):	
Regular (91 octane)	10.25-10.50
Premium (99 octane)	13.00-13.25
Natural gasoline (26-70)	4.5
Breckenridge	4.0
Gulf Coast (cargoes for coastwise or export movements):	
Regular (90 octane)	10.50-10.75
Regular (92 octane)	10.75-11.00
Premium (98 octane)	12.00-12.25
California (rack) Los Angeles):	
★ Regular (88 octane)	11.65-12.15
★ Premium (94 octane)	12.65-13.15
★ Premium (100 octane)	14.00-14.65
Caribbean area (cargoes):	
Regular (87 octane)	10.375
Premium (97 octane)	12.00

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

KEROSINE AND DISTILLATE

Mid-Continent (Group 3):	
★ Kerosine 42-44	10.25
★ Diesel oil (58 d.i. and above)	10.00
★ Distillate No. 1	10.00
★ Distillate No. 2	9.25
Gulf Coast (cargoes):	
★ Kerosine 41-43	9.00
★ Distillate No. 2	8.375
New York Harbor (barges):	
Kerosine 41-43	10.10
Distillate No. 2	9.60
Diesel fuel, 48-52 d.i.	9.90
Caribbean area (cargoes):	
Distillate No. 2	8.125

RESIDUAL FUEL (BBL.)

Mid-Continent (Group 3):	
★ Residual fuel (max 1% S)	$1.80-1.90
Gulf Coast (cargoes):	
Bunker C fuel	$2.00
New York Harbor (barges):	
Bunker C fuel	$2.37
Caribbean (cargoes):	
Bunker C	$2.00
California (rack):	
Bunker C fuel, Los Angeles	$2.15

Tanker Rates (Long Ton)

(Latest reported spot fixtures)

★ Gulf-USNH, clean (ATRS—12.5%)	$2.49
★ Carib.-USNH, dirty (ATRS—47.5%)	1.44
★ Carib.-UK, dirty (Scale—52.5%) (15s. 5d.)	2.16
★ PG-UK, dirty (Scale—45%) (32s. 7d.)	4.56

★ Denotes change from previous week.

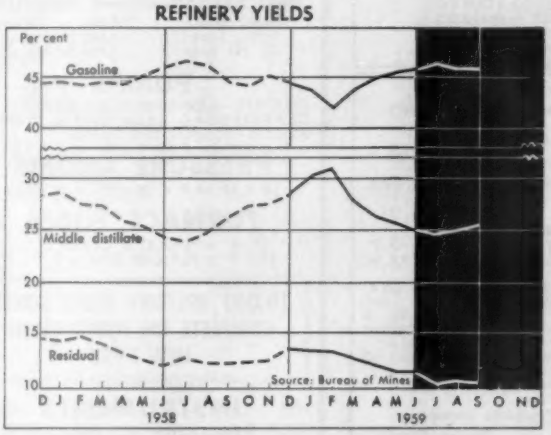
SUPPLY AND DEMAND—MAJOR PRODUCTS

(Thousands of barrels daily)

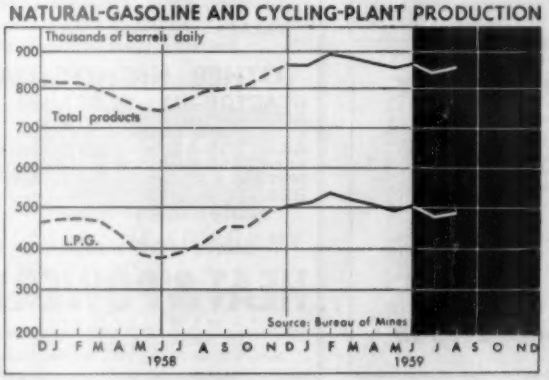
	Total demand	Refinery production	Stocks end of period†
GASOLINE			
November 1959*	4,000	4,060	180,000
October 1959*	4,040	3,940	176,000
September 1959	4,401	4,072	174,128
December 1958	3,950	4,146	186,760
November 1958	3,686	4,029	178,574
KEROSINE			
November 1959*	400	330	32,300
October 1959*	270	295	33,000
September 1959	267	277	31,562
December 1958	572	374	26,040
November 1958	346	350	32,120
DISTILLATE			
November 1959*	2,325	1,790	167,000
October 1959*	1,530	1,735	181,600
September 1959	1,456	1,745	174,148
December 1958	3,179	1,955	125,101
November 1958	1,968	1,812	161,192
RESIDUAL			
November 1959*	1,690	932	55,200
October 1958*	1,370	850	58,000
September 1959	1,325	853	59,429
December 1958	2,084	1,105	59,508
November 1958	1,488	979	66,223

*Preliminary. †Thousands of barrels.

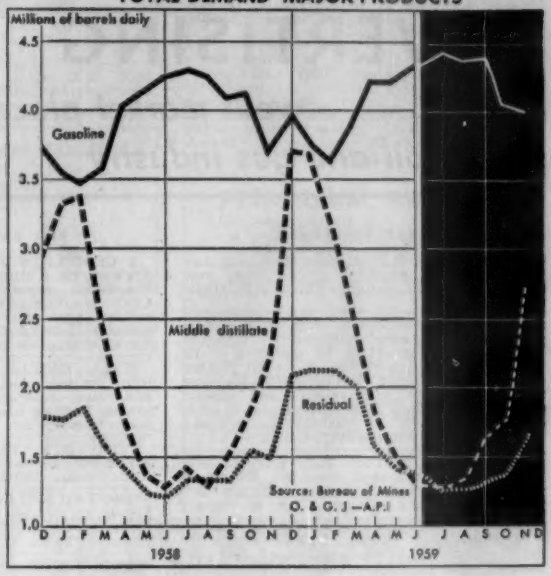
REFINERY YIELDS



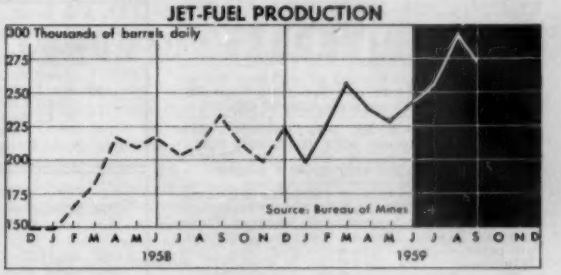
NATURAL-GASOLINE AND CYCLING-PLANT PRODUCTION



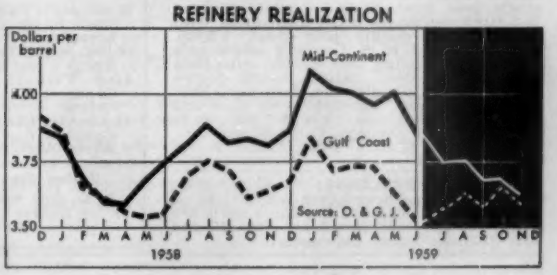
TOTAL DEMAND - MAJOR PRODUCTS



JET-FUEL PRODUCTION



REFINERY REALIZATION



REFINERY REALIZATION

	Nov.* 1959	Oct.* 1959	Sept. 1959	Nov. 1958
Mid-Continent	$3.63	$3.68	$3.78	$3.81
Gulf Coast	3.59	3.65	3.63	3.63

*Preliminary.

Refinery realization is based on yields of major products and average spot prices of regular gasoline, kerosine, No. 2 fuel, and residual as published in The Oil and Gas Journal.

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5—40 and 2—50 H.P. 2-cycle new Superior Horizontal gas engines. Never been run. Overton Supply Company, Phone 2721, Overton, Texas.

GAS COMPRESSION PLANT complete with practically new packaged Worthington Compressors, size 17 x 13 and 9¼ x 13, Happy HFR-36 gas cooler, 2—LeRoi H-2,000 motors, compressor building, 6—Westcott meters complete with meters and piping, 2—500# 5 M M and 35 M M National separators, 1—500# 5 M M National Dehydrator. Alvin Johnson, Phone 6661, Oil City, La.

A REAL BUY—Two 36-L Bucyrus-Erie Drilling Machines, skid mounted, GK Waukesha engines, located, Luling, Texas. Priced exceptionally low. Degen Pipe & Supply Co., Tulsa, Oklahoma.

FOR SALE: Failing 1500 heavy duty drilling rig truck mounted, 5 x 8 Gardner Denver pump and motor, welder, light plant on trailers, 1200 water tank on R185, 2-ton flatbed winch and headframe, Pickup, House Trailer, 1,680 feet 2⅜ drill pipe, diamond core barrels, 8 drill collars, subs, adaptors, handtools. Graystone Drilling Co., 404 Texaco Bldg., Dallas, Texas. RI 7-5707.

DRILL pipe, 2⅞", 2⅜" 20 ft. Franks KC 45 complete. Failing 1500. Box L-605, The Oil and Gas Journal, Tulsa, Oklahoma.

18" AND 20" good used pipe. Very attractive prices. Contact: The Tri-State Pipe Co., Bellaire, Ohio. Telephone OR 6-1452.

1 BUCYRUS—ERIE 36L Spudder, late model. Rig complete with tools and equipment. Cassel Drilling Co., Inc., Dumas, Texas. Phone WE-5-5019 or WE 5-4369.

A REAL BARGAIN—3 complete RL Cardwells, with 150/HP engines, 2 with telescopic masts; one only 7 years old. Located Tulsa, Pampa, Texas, Chase, Kansas. Unusually low price. Degen Pipe & Supply Co., Tulsa, Oklahoma.

RE-WORKED WELL SERVICE WORK-OVER UNITS
Ready for use. Truck mounted Wilson Senior single drum servicing unit with single pole mast, $4,000. Trailer mounted N-3 Brewster single drum drawworks with 85/8"x103/4"x87' double pole mast, $15,000. Truck mounted H. S. Cardwell single pole mast well servicing unit, $4,500. All prices F.O.B. Tulsa, Okla. Wilson Mogul double drum spudder, double pole mast, 145 G.K.U. Waukesha power, complete with lines and tools, F.O.B. Seminole, Okla., $11,750. Write or call: Franks Division, Cabot Shops, Inc.; 3218 Whittier Station, Tulsa, Okla. Phone WEbster 9-6381.

FOR SALE OR LEASE: Three (3) large perforating trucks complete with 16,000' of 7/16" single conductor line. These units are ready for the field. Box L-614, The Oil and Gas Journal, Tulsa, Oklahoma.

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3 COMPLETE UNIT rigs for sale U-15 drawworks. 2 Rigs are powered by 3 NKU Waukesha engines. 1 rig powered by 2 LRO Waukesha engines. Drill pipe and collars optional. Rigs may be seen at Henson Drilling Company yard in Abilene, Texas. Complete inventory on request.

WELL DRILLS—CORE DRILLS. Everything for well and core drilling in both new and used equipment at money saving prices. Fishing tools rented. Send for bulletins. Pressey & Son, Pueblo, Colo.

COMPLETE, TRAILER mounted Rotary Rig, 2,000', all tools, Good Condition, $15,000. J. C. Owens, HE 9-6640, Comanche, Okla.

1500 FAILING heavy duty, 2,000' drill pipe, $10,000.00. KC 45 Franks complete. Walker-Neer Spudder. Box L-618, The Oil and Gas Journal, Tulsa, Oklahoma.

FOR SALE—large quantity, good used 10¾" pipe, 35 pounds to foot. 8⅝" eight inch pipe, 28 pounds to foot. Six inch pipe. Large quantity steel plates. Priced to sell. Phone CA 6-0821, Lima, Ohio, or write, West Ohio Pipe Co., P. O. Box 193, Lima, Ohio.

—PIPE—
500,000 ft. 10¾" O.D. 35#
200,000 ft. 8⅝" O.D. 28½#
100,000 ft. 12¾" O.D. 40#
20,000 ft. 16" O.D. 12#
all No. 1 grade, plain end cleaned
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Phone CL 3-5527
Columbus 3, Ohio

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New
5,000'—9⅝"ODx32# Range 2, 8Rd, T&C, Seamless Steel Casing
5,400'—13⅜"ODx54# Range 2 and 3, 8Rd, T&C, Seamless Steel Casing

Used
50,000'—10¾"ODx40.5# No. 1 Grade, 8-V, T&C, Range 1, Excellent for Casing or Line Pipe
20,000'—6⅝"ODx18.97# No. 2 Grade, Range 2 and 3, P.E., Good for Oil Line
8,000'—7"ODx17 & 20# Range 1, No. 2 Grade, 10-V, T&C, Good for Surface Casing
12,000'—4½"ODx10.79# Range 1, No. 2 Grade, P.E., Good for Oil Line
Write, Wire, Phone,

Valley Steel Products Company
P. O. Box 9247 Dallas, Texas
or call George Barber at HAmilton 8-1301

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Most Equipment New 1955

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10' x 145'—125 PSI 50 trays
9'6" x 121'6"—325 PSI 30 trays
8'6" x 103'6"—165 PSI 24 trays
7' x 82'—75 PSI 30 trays
6' x 80'—300 PSI 30 trays
4' x 44'8"—150 PSI 12 trays
3'6" x 36'4"—400 PSI 12 trays
30" x 52'4"—360 PSI 22 trays
26" x 57'—78 PSI 4 trays

CLARK COMPRESSORS

7860 CFM 2 stage CENT. 153PSIG
RA5 Gas Engine 2 VTH 17x14 Cyl.

HEAT EXCHANGERS—CONDENSERS

Steel tube ..... 7,500 to 100 sq. ft.
Adm. tube ..... 3,500 to 236 sq. ft.
Cu Ni tube ..... 2,330 to 308 sq. ft.

PUMPS

HOT OIL—5,150 GPM to 100 GPM
CENTRIFUGAL—12,650 GPM to 25 GPM
STEAM—Simplex and Duplex

PRESSURE DRUMS

12' x 50' to 4' x 10'—325 to 50 PSIG

FURNACE TUBES

33—6" x ⅜" x 27'6" Croloy 9
144—4" x ⅛" x 29' Croloy 5

10,000 BBL/DAY FLUID COKER

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NEW 1955

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VALVES—Diaphragm, Slide, Butterfly, Pressure Regulating

OTHER HIGHLIGHTS

REACTOR—23' x 78' SS Lined
REBOILERS—2700 to 156 sq. ft.
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Domestic Mfgr.
Very Attractive Price

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175 TANKS
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5,000 Tons Tank Plate

OUTSTANDING ITEMS:

- 19,000 BBL. CAT CRACKER (1953)
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- 3—FURNACES 11.4 MM to 15 MM BTU Per Hour
- 150 CENTRIFUGAL, HOT OIL and STEAM PUMPS
- 500 INSTRUMENTS; RECORDING, CONTROLLING, ETC.
- TETRA ETHYL weighing station with 8,500 weighing tank.

—TOWERS—

Dia.	Height	Trays	Psi.
144"	96'	27	25
90"	109'	50	160
90"	56'	20	35
78"	78'	30	245
66"	70'	30	250
60"	76'	28	120
60"	33'	15	245
54"	39'	16	35
54"	32'	10	55
48"	34'	4	275
42"	61'	24	100
42"	22'	8	130
42"	30'	8	25
36"	58'	30	154
36"	47'	20	120

HEAT EXCHANGERS

Quan.	Tube Material	Sq. Ft.
10	Admiralty	2,000 to 4,600
13	Admiralty	920 to 1,730
10	Admiralty	200 to 636
8	Steel	2,000 to 2,600
35	Steel	920 to 1,720
12	Steel	100 to 600
30	Finetube (Adm. & Steel)	20 to 190

COMPRESSORS

Mfg.	Type	CFM	PSI.	HP.
Carrier	Cent.	38,300	32.7	3,370
Carrier	Cent.	9,370	124.7	2,310
Carrier	Cent.	9,750	93	1,410
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"1" ONE OR "2" TWO 48L BUCYUS rigs with or without tools. Phone BR 3-5551; write, 306 Austin, Borger, Texas.

60-L BUCYRUS Erie spudder, excellent condition. Box L-610, The Oil and Gas Journal, Tulsa. Oklahoma.

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Used Pipe—Excellent Condition
100'—14"ODx½" wall 5% Chrome
110'—30"ODx⅜" wall, Steel
450'—20"ODx½" wall, Steel
450'—18"ODx⅜" wall, Steel
500'—16"ODx½" wall, Steel
15 to 36' lengths.
HEAT & POWER CO., INC.
60 E. 42nd St., N. Y. 17, N. Y.

EQUIPMENT WANTED

UP TO 20,000 feet-New or Used 3½" drill pipe with ends prepared for Reed API full hole SSG tool joints. Prefer pipe less joints. Arrow Tool & Supply Ltd., 5919 104 St., Edmonton, Alberta, Canada.

WANTED: 36 & 28 L Bucyrus Erie Drilling Rigs, Tools, Large capacity Turbine Pumps. Meridith Corporation, P. O. Box 470. Orlando, Florida.

HELP WANTED

HELP WANTED

PIPE LINE SURVEYOR Major Gas Transmission Company, headquarters in Midwest. Age to 35. Experience in pipe line location, office and field drafting necessary. Box L-598, The Oil and Gas Journal, Tulsa, Oklahoma.

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A position is being created in our Gas Supply Department for a graduate petroleum engineer with a minimum of five years experience in petroleum engineering. Experience in reservoir computation is preferred. Location would be Amarillo, Texas. Your reply should include: education, experience, salary expected, business and personal references and a recent photograph of yourself.

Send resume to:
PERSONNEL DIRECTOR,
PIONEER NATURAL GAS COMPANY
P. O. Box 511, Amarillo, Texas

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Several selected openings exist for graduate ChEs or MEs with 2-6 years' experience in the process equipment industry in process, design or operations of which two years should be in appropriate estimating and engineering economics experience.

Opportunity for man with original thought, imagination and process equipment knowledge. Duties will include determination of material and equipment needs, equipment arrangements, process suitability, process or component economics and cost data. Will prepare cost estimates which include material, labor, outside purchased components, engineering time and operating costs which comprise total costs of equipment, plants or products to be sold or furnished by the company. Individual must be able to deal effectively with all engineering levels.

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Please send résumé to E. J. Strobel, Technical Personnel Manager, Dept. 598.

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Medium size integrated oil company located in Texas has openings for qualified professional personnel. This is a fast growing company offering advancement opportunities to capable men. Please send resume including references, recent photograph and salary required to Box L-616. Replies are strictly confidential and our employees know of this advertisement.

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Graduate chemical engineer with minimum seven years refinery experience covering process design and economics.

SENIOR MECHANICAL ENGINEER

Graduate mechanical engineer with minimum four years refinery or plant experience. Experience in plant maintenance and preferably some experience in design.

SENIOR PROCESS ENGINEER

Graduate chemical engineer with minimum four years refinery or refinery design experience. Should include plant technical services.

JUNIOR PROCESS ENGINEER

Graduate chemical engineer. No previous experience necessary.

MATHEMATICIAN or COMPUTER PROGRAMMER

Bachelor of Science graduate with educational emphasis in mathematics or physics, preferably both. No previous experience necessary.

GROWING INDEPENDENT refinery in Midwest has opening for young, aggressive Assistant Superintendent. Excellent growth opportunity. Please respond giving age, experience, marital status, etc., as well as salary requirements. Box L-619, The Oil and Gas Journal, Tulsa, Oklahoma.

FIELD ENGINEER Graduate Civil Engineer for permanent position with Major Gas Transmission Company located in Midwest. Age to 35. Experience in office design, location and property surveys. Must travel. Box L-589, The Oil and Gas Journal, Tulsa, Oklahoma.

CHEMICAL ENGINEER with several years experience related to gasoline plant process and mechanical design. Send resumes to Box L-588, The Oil and Gas Journal, Tulsa, Oklahoma.

FOREIGN—DOMESTIC Employment Oil, Chemical, Industrial. Write for details without obligation. Accredited Personnel Services, P. O. Box 6006, New Orleans 14, La.

NFW OIL JOB Directory, foreign and domestic, showing where to apply for jobs. 500 selected producing, refining, butane and pipeline companies. Nationwide, $6.00 cash. OIML Co., Box 2603, Tulsa, Oklahoma.

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Baker Oil Tools, Inc.

Desire graduate engineers with oil field background, preferably with research and design experience. Engineers presently employed by Oil Companies will be employed only with the understanding and approval of their company. Please apply to Personnel Department in Los Angeles, P.O. Box 2274, Terminal Annex, Los Angeles 54, California, or in Houston, P.O. Box 3048, Houston 1, Texas.

LPG OPERATIONS EXECUTIVE

To function at management level in new, sizeable LPG operation. Age 35-45. Degree in Chemical Engineering or Petroleum Engineering preferred. Must have 15-20 years experience in processing, storage, transportation and handling of LPG. Some knowledge of sales preferred. Salary commensurate with ability and experience. Send complete resume including background, training and experience. All replies will be held in strictest confidence.

Box L-603,
The Oil and Gas Journal
Tulsa, Oklahoma

SITUATION WANTED

SENIOR GEOLOGIST, large chemical corporation, desires more challenging employment where multiple talents can be used. Experienced in both exploration and development of petroleum, mineral deposits, and ground water; proficient in land work. Youthful, married, family. Box L-613, The Oil and Gas Journal, Tulsa, Oklahoma.

YOUNG MANAGER of oilwell servicing company, seeks supervisory/executive position with servicing or drilling contractor in any part of the world. 11 years domestic and foreign experience. Would establish and manage new company for any interested parties. Any challenging opportunity would be considered. Box L-611, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM ENGINEER (BS), also (BA) Geology, 41, family. Nine years diversified experience in drilling, completion, workovers, production and some reservoir. D. W. Swanson, 711 Oak Street, Red Oak, Iowa.

MECHANICAL Engineer, 11 years experience Drilling, Equipment, Production Engineering. 35 years of age, married, desires responsible engineering or supervisory position, foreign or domestic. Box L-612, The Oil and Gas Journal, Tulsa, Oklahoma.

SITUATIONS WANTED

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PETROLEUM ENGINEER: 32, 6 years experience in primary and secondary recovery in Illinois, Kansas, Oklahoma and Texas. Presently employed as engineer in well completions and acquisition of secondary prospects. Prefer individual or independent company. Resume on request. Box L-609, The Oil and Gas Journal, Tulsa, Oklahoma.

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FINANCIAL CONTACTS. Underwriters, Private Brokers reached. No shopping. Confidential. Send details to Consultant, 817 51st Street, Brooklyn, N. Y.

NEW PRODUCTS WANTED—Well-established, responsible company with complete facilities for developing, manufacturing and marketing oil field equipment is seeking new or improved products, preferably patented or patentable to add to its presently well-known line. Royalty basis or outright purchase. Initial submission should identify product and general use without revealing engineering and confidential detail. Submissions will be handled promptly and confidentially. Box K-994, The Oil and Gas Journal, Tulsa, Oklahoma.

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LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Washington 25, D. C. Notice is hereby given that 402 acres of acquired lands in the George Washington National Forest, Dry River Ranger District, Plains District, Rockingham County, Virginia, within the known geologic structure, undefined, of the Bergton-Crab Run Field will be offered for oil and gas leasing in one parcel through competitive bidding to the qualified bidder of the highest cash amount per acre at 1 P.M., E.S.T., January 6, 1960, when bids will be opened. Bids may not be modified or withdrawn unless the modifications or withdrawals are received prior to the time fixed for opening of the bids. Details of the lease offering, how and where to submit bids, may be obtained from the Bureau's Eastern States Land Office, Washington 25, D. C. H. K. Scholl, Manager, Eastern States Land Office, Washington 25, D. C.

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Santa Fe, New Mexico. Notice is hereby given that approximately 177.27 acres of land in 4 parcels within the known geologic structure of certain fields in Beaver, Texas, Harper, and Tillman Counties, Oklahoma will be offered for oil and gas leasing through competitive bidding to the qualified bidder of the highest cash amount per acre at 2:00 p.m., MST, January 19, 1960, when bids will be opened. Details of the lease offering, how and where to submit bids, may be obtained from the Bureau's Land Office at Santa Fe, New Mexico. Douglas E. Henriques, Manager.

ROYALTIES

HIGHEST PRICE PAID for oil and gas income royalties, overrides, oil properties. A. S. Berry, 109 Midco Bldg., 302 South Cheyenne, Tulsa, Oklahoma.

LEASE AND DRILLING BLOCKS

10,000 Acre, Oil Lease block on good geology Comanche County, Oklahoma. Need company or associates to drill 5,000 foot well. Carl Bergman, Box 301, Lawton, Oklahoma.

SEVEN WELLS, 20 BOPD, settled production, in Eastern Kansas, by owner. Box L-615, The Oil and Gas Journal, Tulsa, Oklahoma.

WATER FLOOD Franklin County, Kansas. 640 acres, good engineering and best equipment, modern in every respect. Wonderful potential, good reason for selling. No brokers. Unless you are financially responsible do not reply. Box L-326, The Oil and Gas Journal, Tulsa, Oklahoma.

WATER FLOOD Kevin-Sunburst field in Montana. Lab analyses of recent cores show 37' saturated pay zone and indicate approximately 3 million barrels of pipe line crude oil to be recovered by water flooding. We would like to contact parties with 'WATER FLOOD' know-how and finances to extend our present pilot flood. This is not an offer of sale. Imperial-Craig Co., Kevin, Montana.

SOME SHALLOW drilling deals with good geology. If interested write for particulars. References furnished. R. E. Clement, Box 65, Norman, Oklahoma.

OIL AND GAS MINERAL LEASES available in Dell City area of Hudspeth County, Texas. U. S. Geological Survey Map shows anticlinal axis nearby favorable for oil-gas structure. Am free landowner of over 2,000 acres. Write quickly to: Jefferson G. Smith, 715 Littlefield Building, Austin 15, Texas.

40 ACRE OFFSET—to producer 750 ft., Bartlesville sand. Montgomery County, Kansas. Will need some financial help. Have rig and tools. Box L-607, The Oil and Gas Journal, Tulsa, Oklahoma.

KENTUCKY oil and gas leases available for sale or drilling, all or part of 4,500 acres in Metcalfe and Barren Counties. Shallow drilling with good geology. Box L-608, The Oil and Gas Journal, Tulsa, Oklahoma.

WISE COUNTY, Texas, landowners want drilling contract. 600 acres, very hot, production nearby on three sides. Long lease just expired. Write quickly, wire or see, Roy Alexander, Route 2, Alvord, Texas.

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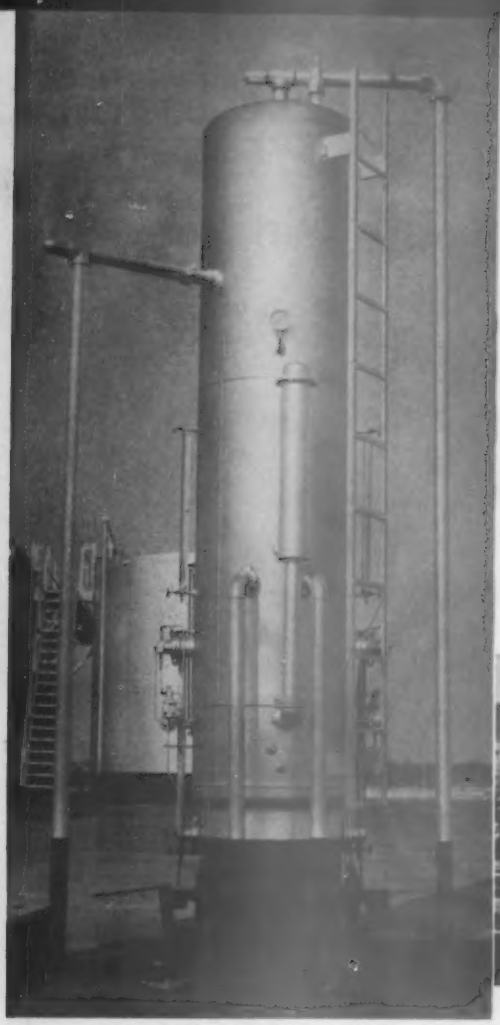

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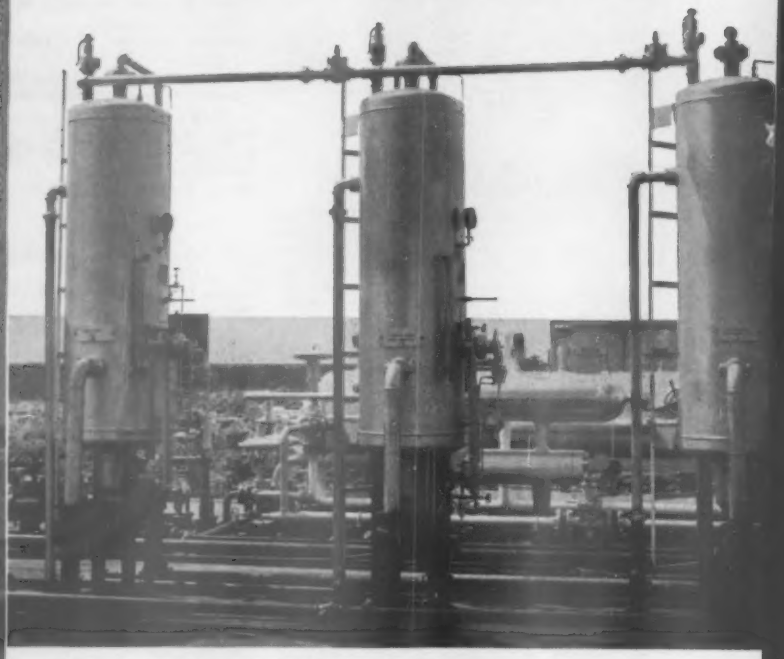

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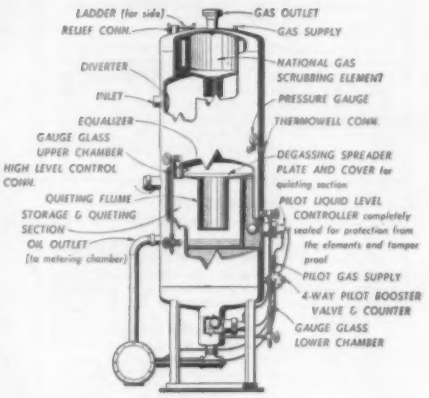

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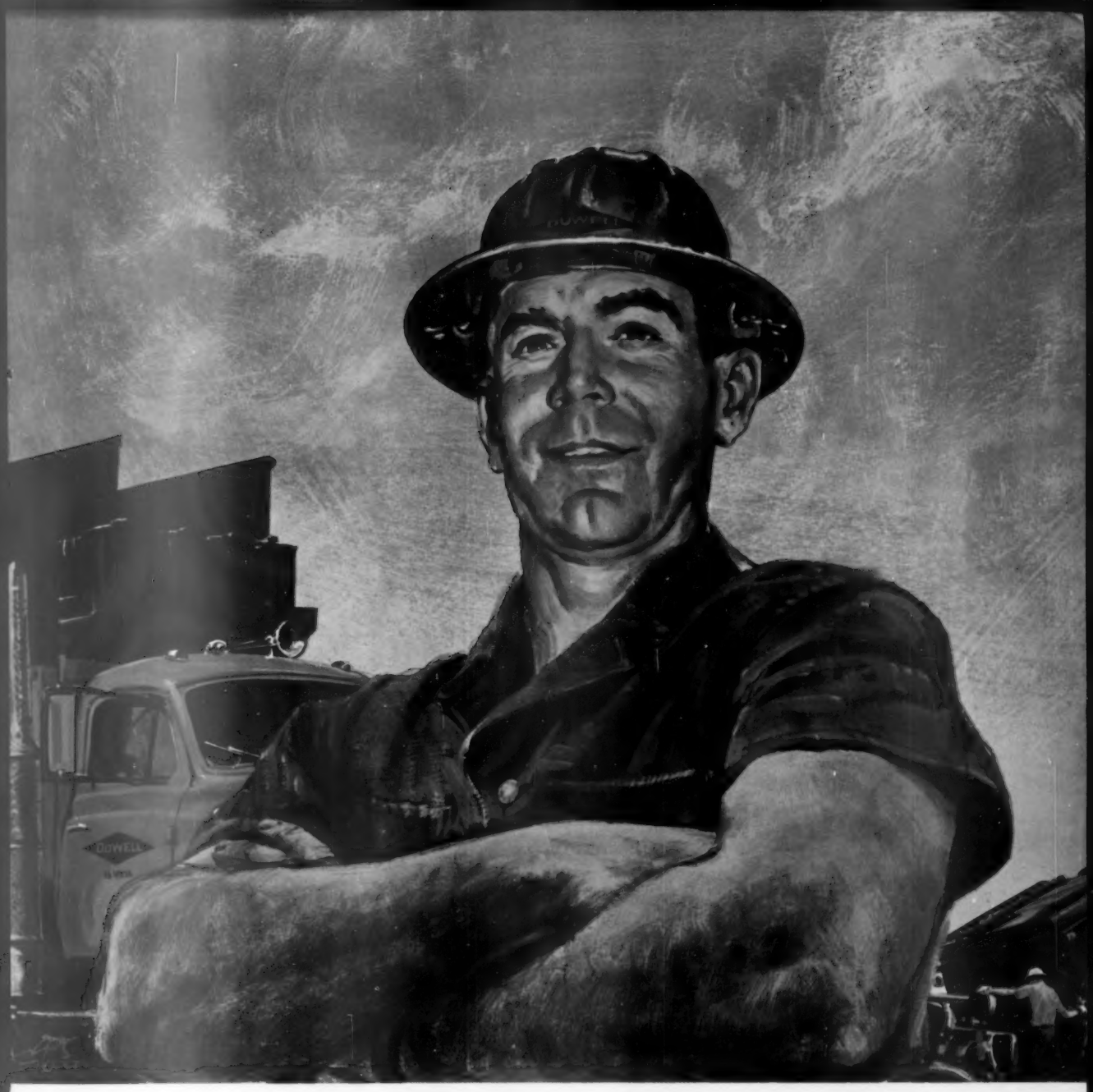

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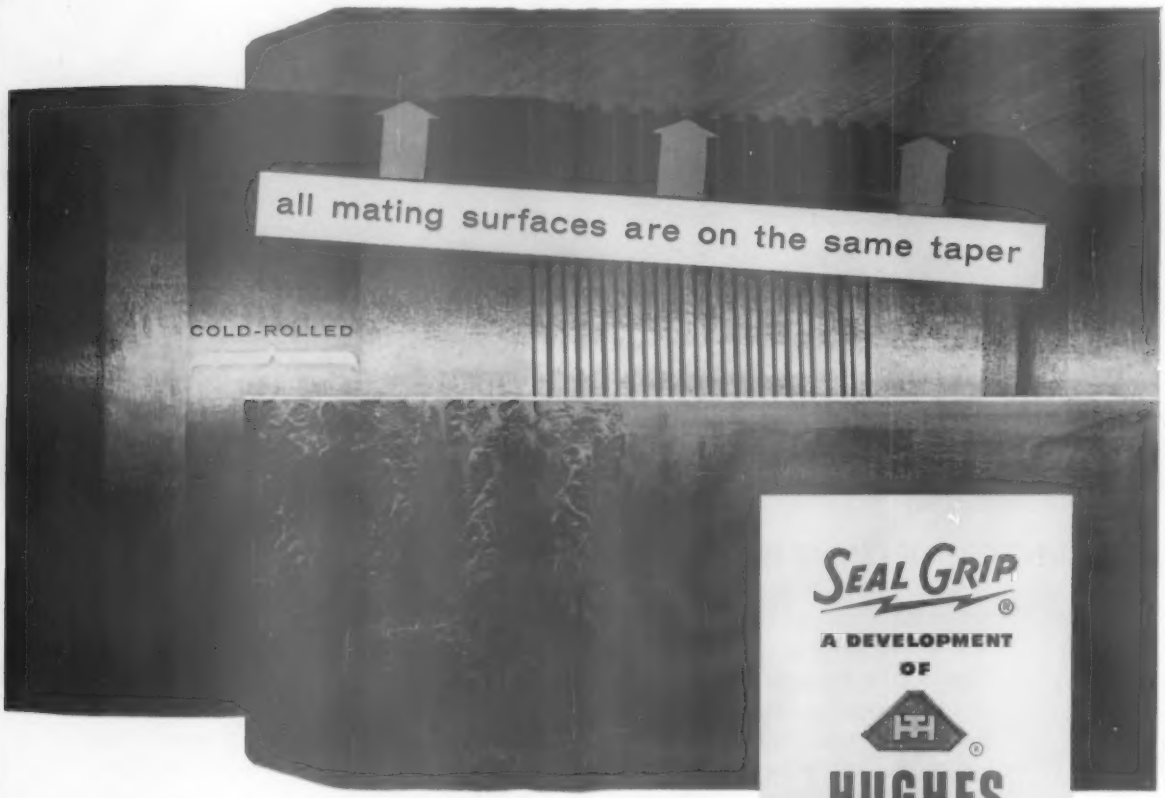

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